Agricultural Experiment Station

of the

University of Kentucky

SIXTIETH ANNUAL REPORT

Report of the Director

for the year 1947

COMMONWEALTH MYCOLOGICAL INSTITUTE
4 OCT. 1948

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* Lewis, E. B., Resigned 6-14-47
* Rapp, K. E., Resigned 7-31-47

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* Taylor, E. L., Resigned 4-26-47
* Udall, Robert H., Resigned 9-20-47
* West, Mary G., Resigned 4-12-47

LETTER OF TRANSMITTAL

To His Excellency, Hon. Earle C. Clements, Governor of Kentucky:

Sir: In accordance with an act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and of the act of the Legislature of the State of Kentucky, approved February 20, 1888, entitled, "An act to accept the provisions of an act passed by the Congress of the United States, approved March 2, 1887, for the establishment and maintenance of Agricultural Experiment Stations in connection with Agricultural Colleges established by the several states and territories under the act of Congress approved July 2, 1862," I herewith submit the sixtieth annual report of the Kentucky Agricultural Experiment Station.

Very respectfully,

THOMAS P. COOPER, Director.

ANNUAL REPORT
of the
DIRECTOR OF THE KENTUCKY AGRICULTURAL EXPERIMENT STATION
For the Year 1947

(See "Index to Subject Headings," pages 74-6.)

Farmers' progress in cooperation

Mutual aid continues to be an important force affecting the well-being of farmers in Kentucky. It takes many forms – from informal, unorganized cooperation to the formal enterprise, organized along lines of modern business and in conformity with corporate forms designated by law. Large numbers of Kentucky farmers participate in enterprises of the latter type. Total known number of farm cooperatives in 1947 was 237, with total membership about 470,000. These figures do not include many small informally organized cooperatives nor the large number of nonmember farmers served by cooperatives.

The largest group of farmers organized for cooperative effort was in marketing of farm products, about 265,000, of whom 237,000 were members of tobacco marketing associations. The 1946-47 marketing year was one of unusual activity for the tobacco pools, which marketed large quantities of tobacco that farmers might obtain commodity loans under the federal loan price support program. Membership in cooperative insurance companies ranked second, with 72,425 members. Rural electric associations were third, with 69,582 members. Cooperative purchasing, cooperative credit, and animal services also held important places.

Total volume of farm products handled was about 76 million dollars. Of this amount approximately 38 million dollars was for tobacco handled by tobacco pools from the 1946 crop. Value of cooperative purchases was about 6 million dollars. Insurance in force with farmers' assessment fire insurance companies was in excess of 100 million dollars. Amount of credit extended through the cooperative credit system was in excess of 22 million dollars. The mileage of energized line of rural electric associations was 16,327.

Of the 237 cooperative associations, 5 were organized to operate on a state-wide basis, 8 were regional cooperatives, and 224 were essentially local cooperatives each serving a territory easily reached by farmers. These local associations tended to serve a larger area as

rural transportation improved, and thus operated under increasingly favorable conditions of potential volume and lower costs. For example, the original 118 national farm loan associations were consolidated into 29 associations in 1947. Similarly, in strawberry marketing, the number of cooperative associations declined and the area served by the remaining cooperatives was enlarged.

Louisville Fall-Premium Plan for seasonal milk pricing

The operation of the Louisville Fall-Premium Plan in seasonal milk pricing was analyzed and evaluated in a study completed this year. The purpose of the plan is to stimulate fall production of graded milk without corresponding expansion in spring production. The established price differential in favor of fall production is a consistent incentive toward uniformity of total market receipts and the individual producer's return is automatically determined by his own contribution to greater uniformity. From the individual producer's point of view, the incentive must be continuous and large enough to warrant changes in management of his dairy herd. Despite three years of experience in which total market receipts do not show it, a number of producers have changed their production plans and many others are giving serious consideration to the implications of the plan.

While the fall-premium plan is having its effects on some shippers, others are being influenced by such things as the price of milk, the farm labor situation, income from other farm enterprises, and less tangible factors as well. In addition, the trend toward individual expansion and increased numbers of producers is well established. All these factors are important and their impacts on production may be such as to overshadow the less spectacular developments in the direction of adjustments in the seasonal pattern of production. Accordingly, over-all market data needs to be used with caution in evaluation of the fall-premium plan. The plan is not a device for limiting over-all production, and is perhaps least effective when the general level of milk prices is such that it pays to produce all the milk possible at all times of the year, with or without the plan.

Shifts in farming after World War I

Farm organization and income on 108 farms in Mason and Fleming counties (Outer Bluegrass Area) in 1939 were compared with farm organization and income on the same farms in 1922, in order to cast more light on possible present and future trends. Changing economic conditions, new farming practices, and government control of certain aspects of farm production resulted in numerous adjustments within the 18-year period. The acreages of hay, seed crops, and pasture increased while acreages of corn, wheat, and tobacco decreased.

Sheep and beef cattle numbers increased but hog, dairy cattle, work stock, and poultry numbers decreased. Livestock receipts as a proportion of the total farm income increased from 36 to 39 percent. On the other hand, income from tobacco as a proportion of the total income decreased from 53 to 44 percent. Total income per farm was 21 percent lower in 1939 than in 1922, and farm operating expenses were 23 percent lower. Labor costs decreased more than the other expense items.

The average operator's net earnings for the 108 farms was $1,268 in 1922 and $879 in 1939. Although average incomes were lower, crop yields and livestock production were higher in 1939 than in 1922.

As measured by labor and management incomes of the farm operator, the farms most successful in 1922 were the successful ones in 1939. Also, by and large, the least successful or low-income farms in 1922 were also least successful in 1939. The relatively large farms not having extremely high operating expenses were usually the successful farms. Other factors affecting success were efficient use of labor, price received for and yield of tobacco, and livestock production.

Breathitt county forestry demonstration

The project plans for 1947 called for establishment of as many woodland management demonstrations as possible, and every effort was made toward this end. Plans on eight new demonstrations, totaling 1,588 acres, were set up ready for action by the property owners. At the end of the year, however, only two of these cooperators, both owners of small properties, had actually started work on their properties according to plan – one by interplanting understocked areas, the other by thinning a young oak stand. In addition to the establishment of new demonstrations, 26 owner's plans prepared from data gathered in the first 3-year project, were completed and delivered. All of the 26 property owners have agreed to varying amounts of cooperation in woodland management.

Further progress in fire control was made this year. In 1945 about 16,000 acres in the area burned; in 1946, about 7,000 acres burned; and in 1947, about 1,100 acres burned. In the spring of 1947, in cooperation with the already organized voluntary fire control groups, 39 regularly scheduled pre-fire-season meetings were held and fire prevention talks were given in five schools. In the fall, a 5-week program of motion pictures on soil and forest conservation was given.

Experimental development of wood-processing equipment

Preliminary field work on plans for the experimental development of a dual engine drive for small sawmills has been completed. The Aeronautical Research Laboratory of the University of Kentucky is well under way with the construction of such a power unit.

Effect of soil improvement on income, on a run-down farm

Effect of soil improvements was studied over a 10-year period on a 70-acre farm with gently rolling, well-drained, limestone land in southwestern Kentucky (Warren county). At the start, this farm was low in productivity, about 20 acres being depleted, idle cropland covered with weeds, bushes, and lespedeza. As a result of soil improvements, all the cropland was brought into use, and the volume of crops and pasture produced the tenth year was nearly 4 times that of the first year. (The comparison was not affected by either unusually favorable or unusually unfavorable weather either year.) The value of crops, at 1936-39 average prices, increased each year – from $1,055 the first year to $3,958 the tenth year. Labor required for crop production increased from 880 man-hours to 2,200. Annual cost of fertilizer, seed, harvesting grain and grass seeds, other crop supplies, and additional housing space for tobacco increased (at 1936-39 average prices) from $309 the first year to $1,041 the fourth year, and then decreased to about $600 annually for the 6th to 10th year. Differences between these costs and the value of crops produced increased each year, from $746 the first year to $3,310 the tenth year. At prices prevailing from 1942 to 1945 these differences were practically doubled.

The principal soil improvements were liberal use of green-manure crops, sod or cover crop on practically all fields during winter, agricultural limestone, fertilizers, and manure. Liberal seedings of grass-legume mixtures were made throughout the period. Carrying capacity of pastures was improved from one animal unit per 3-to-5 acres (varying with weather conditions) to one animal unit per 1-to-2 acres.

Although the land was gently rolling the types of soil on the farm erode easily. To aid in controlling erosion, terraces were constructed in four fields. A field too wet for cultivation was drained and changed into productive cropland. Where practicable, fences were rearranged to enclose land of similar type in the same field. These land improvements helped conserve the land and also increased production.

Trends of tobacco-livestock farms in the Bluegrass Area, 1930 to 1946

During the 17 years 1930-46 the acreage per farm among tobacco-livestock farms of the Bluegrass Area increased slightly, and the proportion of small and medium farms decreased. In 1946 about 27 percent of the farms were 21 to 70 acres, 34 percent were 71 to 120 acres, and 39 percent were 121 to 260 acres. A larger proportion of the small farms were in the rough, hilly sections of the area than in sections where topography is more favorable for farming.

Total acreages of harvested crops and pasture changed very little during the 17-year period, but acreages of various kinds of crops

changed considerably. Average corn acreage decreased nearly one-third, but corn yields increased about 20 percent. The acreage of burley tobacco per farm decreased, beginning in 1934, and then during 1943-46 increased and slightly exceeded the acreage of the early thirties. Average burley yields per acre in recent years exceeded that of the early thirties by nearly 50 percent. Acreages of small grain harvested changed very little. Total hay acreage per farm increased about 30 percent; alfalfa hay acreage doubled and was one-fourth of the total hay acreage in 1946. Average production of hay per acre in recent years was twice that of the early thirties.

Livestock numbers changed considerably during the 17-year period. Cattle of all types gradually increased, the average increase per farm being about 50 percent. Number of sheep remained fairly constant until 1944, and then decreased to about 70 percent of the number in the early thirties. The number of hogs, chickens, and work animals did not change significantly.

Economic position of small farms in south-central Kentucky

Information on farm organization and income was obtained for 108 farms in representative areas of rolling-ridge and broad-ridge districts (classified on basis of soil type and topography) in 8 counties of south-central Kentucky. Broad-ridge farms included had an average of 25 acres of cropland, and rolling-ridge farms an average of 21 acres. Farms with less than 40 acres of cropland were considered as small farms. Average size of all farms in the broad-ridge areas was 40 acres of cropland, and 60 percent of the farms had less than 40 acres. Average size of all farms in the rolling ridge areas was 43 acres of cropland, and 57 percent had less than 40 acres.

Ten outstanding small farms in the area were selected for intensive study to determine profitable farming systems for small farms. Five outstanding farmers in the broad-ridge areas had an average gross income of $2,812 for the year ending March 1947, compared with $1,486 for 51 representative farmers in the same area. Five outstanding farmers in rolling-ridge areas had an average gross income of $2,877, while 57 representative rolling-ridge farmers averaged $1,980. The operator's earnings of the outstanding broad-ridge and rolling-ridge farmers were $1,563 and $1,597 respectively, compared with $822 for representative broad-ridge farmers and $1,172 for representative rolling-ridge farmers.

Effect of improved land husbandry on organization and income of rolling-land farms

Records on two farms in the rolling-to-hilly areas of Kentucky Type-of-Farming Area VII over the 5 years 1942-46, show the effects upon income of sound land husbandry involving the use of land

according to its natural adaptability, and adoption of needed conservation practices. Each farm showed, over a 5-year period, a slight reduction in expense while income averaged about $2,000 per year more than before the reorganization for Farm No. 1 and about $1,200 for Farm No. 2. All items of expense and income were adjusted to compensate for differences in price-levels during the period.

Major income increases were from sale of grain crops, beef cattle, and hogs. Expenses increased for crops and machinery and decreased for feeds on both farms. Farm No. 1 had higher labor expense after reorganization than before. During the 5-year period the differences between receipts and expenses ranged from $1,519 to $4,325 per year for Farm No. 1 and from $1,027 to $2,605 for Farm No. 2.

Systems of farming for the Lower Ohio Valley Crop-Livestock Region of Kentucky

The Lower Ohio Valley Crop-Livestock Region comprises about 6 percent of the land area of Kentucky and included at the time of this study 10,186 farming units. Three major land class areas occur in the region: Ohio river overflow land, Area A; level-to-undulating land, Area B; and rolling-to-hilly land, Area C. On the farms having the higher efficiency and greater production capacity made possible by improved land husbandry and wisely chosen and correctly combined crop and livestock enterprises, farm income was significantly greater than other farms. Crop yields were about 30 percent higher for the upper one-fourth of 278 farms in a randomized sample for the region. Land-use practices such as contour cropping and cropping the land according to natural adaptation increased yields. Mechanization, better work methods, and efficient crop and livestock production increased labor accomplishment.

Labor income (based upon average prices of 1939, 1940, and 1941) was calculated to be more than $900 per farm greater for farms carrying out the proposed organization and operation than under typical farm systems.

Potential increases in labor and investment income were calculated to be slightly greater for the better land than for poorer land — $880 increase per farm for Land Class Area C, $1,060 per farm for Land Class Area B, and $1,180 per farm for Land Class Area A.

Farm labor in the Central Bluegrass Area

During 1947 information was gathered from 278 typical farm wage workers in the Central Bluegrass Area on income, employment, type of farm work, and wages received. Average net earnings was $1,117 in 1946, the number of days employed being the most important factor determining income. However, those workers who had the highest employment had the lowest average daily cash wage since many of them were employed by the week or month and were

paid for full time whether or not they were engaged in productive farm work. Wage workers who lived on farms had higher net earnings than those residing in rural nonfarm or urban areas. Fuller employment and more even distribution of income throughout the year for farm residents largely accounted for these differences.

Location of residence of the farm wage worker also affected the cost of his services to the farmer. Considering only cash wages, the cost to Central Kentucky farmers in hiring a farm resident in 1946 was, on the average, 19 percent less than the cost for a rural-nonfarm resident and 32 percent less than for an urban resident.

Population changes in three isolated neighborhoods in Eastern Kentucky

The total population in three neighborhoods studied dropped from 377 in January 1942 to 330 in August 1947, a decrease of 13 percent. During the period, 10 people died, 54 were born, 61 moved in, and 161 moved out. Only 216 people, or 57 percent of the 1942 population, were still resident in 1947; 3 percent had died, and 40 percent had migrated.

For another study, the people of the three neighborhoods were divided, on the basis of their own evaluations, into three "prestige groups," those considered the "best" people, those considered the "worst," and a group in between. In this study an attempt was made to see whether there were any differences in migration patterns of the three groups. It was found that from July 1, 1942, to September 15, 1945, 43 percent of the highest-ranking group, 42 percent of the lowest-ranking group, and 34 percent of the "in-between" group had left the three neighborhoods. Of the migrants of the highest-ranking group about six-sevenths left the mountain region entirely, while only about one-third of the migrants of the lowest-ranking group left the mountain region, the remainder going to nearby neighborhoods. Of the intermediate group, about half the migrants left the mountain region.

Returning migration in three magisterial districts 1947

During the summer of 1947 data were gathered on returning migration in three magisterial districts, Graves No. 3, Magoffin No. 1, and Scott No. 3, chosen as being fairly representative of the farming sections of the Purchase, Cumberland Plateau, and inner Bluegrass social subregions. From 1940 to 1947, population had declined 23 percent in the Magoffin district, 8 percent in the Scott district, and 7 percent in the Graves district. In general, the small towns had lost less of their populations than the open-country portions in these three districts.

While many people who left the districts after 1940 had returned

by the summer of 1947, an even greater number had not yet come back. This was clearly shown by the fact that the population in every district had decreased, though on the basis of birth and death rates, an increase would be expected. In all three districts, a great many more men than women had returned. In Magoffin county, two-thirds, and in Graves and Scott counties about three-fourths of the people who had returned were men. Most of the returned persons were young. In all three districts more than three-fourths of them were under 40. In Scott county, 58 percent, and in Graves county 45 percent of them were under 30.

Population in five magisterial districts, 1943 and 1946

In 1943 and 1946 the rural population of five magisterial districts (Carter county No. 6, Clinton county No. 3, Leslie county No. 3, Martin county No. 6, and Owsley county No. 2) was enumerated by interviewing neighborhood leaders. Preliminary figures on changes from 1943 to 1946 were given in last year's annual report. Additional analysis of the data showed that from 1943 to 1946, the combined population of the five districts remained virtually stationary. The number of men per 100 women had increased from 97 in 1943 to 106 in 1946, but had not yet reached the 1940 figure of 111. Age distribution changed very little but of the 1946 residents only 26 percent were 15 to 34 years old, compared with 32 percent in 1940. Average size of household decreased from 4.8 in 1943 to 4.6 in 1946. Even so, as compared with the United States as a whole, the average household in the Mountain Area of Kentucky was large. In February 1946, according to census estimates, 37 percent of the families in the United States had one or more children under 10. In July 1946, 51 percent of the Eastern Kentucky families studied had one or more children under 10.

Effect of work methods and dairy barn arrangement on labor requirements of dairy chores

Labor requirements were studied on 18 dairy farms, 10 of which used some combination of milking room and rest shed, and 8 of which used a conventional stanchion-type barn. Of the 10 using milking room and rest shed, two-cow "walk through" milking rooms were used for 5 herds; four-cow "walk through" for 2 herds; four-cow "walk in and back out" for 1 herd, and six-cow "walk in and back out" for 2 herds. An average of 42 man-hours less labor and 28 miles less walking per cow annually was done by dairymen using the two-cow "walk through" milking room and rest shed combination than by those using the conventional stanchion-type barn. Where a milking machine

was used, however, each cow was in the two-cow "walk-through" type of milking room only 5 or 6 minutes and therefore had too little time to eat the quantity of grain necessary for efficient production. For hand milking with one person milking, the two-cow "walk through" milking room was a time-saving, low-cost arrangement.

Dairymen using the four-cow "walk through" milking room did the dairy chores with 52 man-hours less time per cow annually than the dairymen with the conventional stanchion-type dairy barns, and 10 man-hours less per cow annually than those with the two-cow "walk through" type of milking room, even though the latter arrangement required less walking. Less idle time occurred with the four-cow than with the two-cow type, and each cow had about 12 to 15 minutes in which to eat grain.

Distillers' dried solubles in calf rations

Distillers' dried solubles are rich in protein, niacin, riboflavin, and thiamin, each of which has been found to be important in nutrition of young calves. In an experiment with 20 dairy calves 1 month old and of varied breeding it was found that the dried solubles could be used satisfactorily to replace half or all the dried skimmilk in a grain mixture in which the dried skimmilk had been 25 percent of the mixture. Grains were equal and considerably cheaper when the dried solubles were used. Distillers' dried solubles used in the experiment were richer in niacin, riboflavin, and thiamin, but less rich in protein, than dried skimmed milk.

Artificial insemination program

During the fiscal year ending July 31, 1947, which includes the first 10 months and 12 days of operation of the Kentucky Artificial Breeding Association, 11,486 cows were bred artificially. Of these, 4,833 were Holsteins, 3,752 were Jerseys, and 2,901 were Guernseys. Of all cows bred, 6,560 conceived to the first service. Little difference in conception rate was noted between breeds. At the close of the year 24 bulls were in service at the bull stud, 9 having been removed during the year because of inability to produce semen suitable for dilution and shipping to cooperating technicians. Twenty local cooperatives were receiving semen four times a week. Slightly more than 3,000 herd owners in Kentucky had signed up more than 30,000 cows. For training artificial-breeding technicians the Experiment Station gave four short courses of 6 days each, in which 70 men were enrolled.

Diluters for semen used in artificial insemination

Prolonging the life of spermatozoa increases the efficiency of sires used in artificial breeding. Experiments were made with adding blood serum and glucose, in different proportions, to the usual diluters com-

posed of sodium citrate and egg yolk. Forty-four samples so treated were stored at 40°F and observed for a number of days. Less than 10 percent of the samples so treated were merely equal to or below check samples in quality, and 50 percent were quite superior. One experimental sample lived 41 days and still appeared worthy of use. Blood serum, however, seems to promote clumping of sperm and for this reason can be used only in limited proportions.

Evaluation of quality of semen

Semen for use in artificial insemination of dairy cows was evaluated in the laboratory by the usual methylene blue oxidation test and microscopic observations of motility rate, concentration, and percentage of live sperm. When the evaluations were correlated, by ejaculates, with field conception rates, however, the results were found to be inconsistent and not significant.

A new method of evaluating semen therefore was devised. The diluted semen is incubated at approximately body temperature (100°F) and examined at hourly intervals to note change in vigor and motility. The time taken for the sperm of an ejaculate to lose motility under these conditions is taken as a measure of the time the sperm from that ejaculate are likely to live when placed in the cow. Data were collected on 80 ejaculates (from 8 Holstein and 7 Jersey sires) with which about 4,000 cows were bred. Correlations between these evaluations and conceptions have so far been satisfactory, and it would seem this method of semen evaluation offers an accurate method of estimating probable conception rate.

Effect of granular vaginitis on conception by dairy cows

Over a period of 18 years examinations have been made for presence and degree of granular vaginitis infection in Jersey and Holstein cows of the Experiment Station herd at time of breeding. These observations, involving 1,394 different heat periods, indicate that there was no difference in occurrence or severity of the infection between Jersey and Holstein cows, that there was no definite seasonal variation, and that conception was not influenced by the occurrence or severity of the infection. There was some indication that the infection tended to increase with repeated services for the same pregnancy. There is no indication from the data that the susceptibility to the infection might have been inherited.

Continuous versus alternate grazing of permanent pasture by dairy heifers

Timely rainfall throughout the 1947 pasture season, and unusually mild temperature through July, resulted in the largest yields

recorded during the 12 years of this experiment. Heifers on the continuously grazed half of the pasture gained 453 pounds per acre, while those on the alternately grazed half gained 438 pounds per acre, as compared with a 12-year average of 330 pounds. Calculated in terms of total digestible nutrients, the 1947 yields were 3,076 pounds per acre for the continuous and 3,066 pounds per acre for the alternate grazing. These amounts of nutrients are approximately the amounts furnished by 66 bushels of corn or 3 tons of alfalfa hay.

Pastures for late lambs

Three groups of 12 late lambs each were grazed for 106 days on 2-acre fields of soybeans, Ladino clover, and Korean lespedeza, respectively. A somewhat unfavorable grazing season kept the gains of all lots below those of other years. Heavy summer rains encouraged growth of crabgrass in the Ladino clover and lespedeza lots, and this suppressed the growth of the desirable legumes. The average daily gains per lamb were 0.185, 0.158, and 0.114 pound respectively. The lambs grazing the Ladino clover produced the best carcasses. In previous tests in more nearly normal seasons, lespedeza has usually produced the best gains and finish on late lambs.

Survival of nematode parasites of sheep on pasture

A plot of permanent pasture measuring 12x22 feet and containing bluegrass, white clover, and wild grasses was contaminated with approximately 2 gallons of sheep feces daily from June 15 to July 1. The feces contained eggs of *H. contortus, O. circumcincta, Trichostrongylus spp., N. filicollis, and O. columbianum.* Ten days' exposure on the plot 3 months after contamination failed to establish infestation in three parasite-free lambs, with any of these species. Apparently the larvae from the worm eggs either did not survive the exposure period from July 1 to October 1, or were sufficiently reduced in numbers that infestation did not occur.

Cracked corn versus "sweet feed" for creep-fed suckling lambs

Suckling spring lambs creep-fed to an average age of 100 days, a sweet feed composed of 800 pounds crushed oats, 730 pounds cracked corn, 200 pounds wheat bran, 100 pounds linseed oil meal, 150 pounds molasses, and 20 pounds iodized salt, ate 1.6 percent less grain, gained 9.4 percent faster, and graded very slightly higher in finish than similar lambs creep-fed cracked yellow shelled corn. In a similar previous test the lambs that were fed cracked corn gained 2.1 percent faster on 17.5 percent less grain and graded very slightly higher than those fed the sweet feed.

Continuous versus rotational grazing for unweaned spring lambs

Ten unweaned spring lambs that were grazed with their dams continuously on a 3.45-acre field of bluegrass gained 32.1 percent faster than ten comparable lambs that grazed with their dams on three adjacent 1.15-acre fields in rotation at 2-week intervals. The very small difference in finish of the two groups was in favor of those grazed continuously. In 11 previous tests there had been practically no difference in the average results obtained with the two methods of grazing.

Supplemented cottonseed hulls in feed for sheep

A ration of supplemented cottonseed hulls (30 percent cottonseed hulls containing 10 percent molasses, 51 percent cracked corn, 15 percent cottonseed meal, and 4 percent alfalfa leaf meal) was compared with a standard ration (44.5 percent alfalfa hay, 54.5 percent cracked corn) for lambs. Digestion coefficients and efficiency of utilization of the energy of the digested portion were determined by use of five yearling wethers confined in metabolism crates. The rations were designed to be similar in total gross nutrient and energy content.

The wethers on the supplemented ration digested 91 percent as much dry matter, 82 percent as much protein, 117 percent as much fat, 92 percent as much nitrogen-free extract, and 93 percent as much energy-producing matter as when on the alfalfa-corn ration. There was no apparent difference in digestibility of the fiber of the feeds. The supplemented hull mixture contained 92 percent as much total digestible nutrients as the corn-alfalfa ration.

Fifteen percent of the energy of digestible matter of each ration was lost to the animal by way of the urine and through fermentation in the rumen; and 35 percent of the gross energy of the alfalfa-corn ration and 40 percent of that of the supplemented hull ration were lost to the animal via feces, urine, and products of fermentation in the rumen.

Intake and nutritive value of Ladino clover, orchard grass, Kentucky 31 fescue, and bluegrass consumed by grazing lambs

A total of fifteen wethers (9 yearlings and 6 lambs) grazed, in groups of three, on four forages from early May through mid-August 1947. Daily intake values for dry matter, digestibility, digestible protein, and total digestible nutrients were determined with results as shown in the following table.

Date and Age of Grass	Dry Matter Intake lb/day	Dry Matter Digestibility %	Digestible Protein %	Total Digestible Nutrients %
Orchard grass				
May 7-15, all growth	3.17	77.3	10.6	77.2
June 16-23, 4 weeks	2.91	68.3	8.2	67.3
July 27 - Aug. 4, 5-6 weeks	1.91	59.5	6.3	58.6
Ky 31 fescue				
May 7-15, all growth	3.02	75.5	11.1	76.9
June 16-23, 4 weeks	2.12	65.8	9.1	63.7
July 27 - Aug. 4, 5-6 weeks	1.06	53.6	6.5	56.0
Kentucky bluegrass				
July 3-10, 4 weeks	1.70	51.4	6.7	53.4
Ladino clover				
June 2-9, all growth	3.09	81.0	22.8	80.5
July 6-12, all growth	2.72	79.5	25.6	77.4

Intake and nutritive value of bluegrass eaten by grazing steers

Six grade Hereford steers, averaging 725 pounds and divided into two equal groups, grazed on bluegrass at 2-week intervals from early May through June 1947. One group of steers was used in the May 7-15 and June 8-15 trials, and the other group in the May 22-29 and June 21-28 trials. Daily intake, values for dry-matter digestibility, digestible protein, and total digestible nutrients were as follows:

Date of Trial	Age of Grass	Dry-Matter Intake lb/day	Dry-Matter Digestibility %	Digestible Protein %	Total Digestible Nutrients %
May 7-15, all spring growth		14.9	78.3	14.6	80.4
May 22-29, all spring growth		12.2	63.7	9.0	67.4
June 8-15, three weeks		14.0	67.6	11.8	70.6
June 21-28, two weeks		13.3	62.2	7.2	66.8

Lignification of some forage plants and its effect on digestibility

From April 19 to August 23, weekly samples of alfalfa, Ladino clover, bluegrass, orchard grass, and Ky 31 fescue, from plots at the Station farm at Lexington, were analyzed for lignin. Of each forage, two sets of samples were taken, one set to represent cumulative growth to time of cutting and the other to represent the forage under conditions of grazing. Lignin content at the start, in percentage of dry matter was Ky 31 fescue, 2.15 percent; Ladino clover, 2.45; Kentucky bluegrass, 2.55; alfalfa, 2.9; and orchard grass, 3.0. Maximum percentages, under cumulative growth and simulated grazing, respectively, were: Ladino clover, 4.6 and 3.2 percent; Ky 31 fescue, 7.5 and 5.1; Kentucky bluegrass, 10.5 and 5.1; alfalfa, 11.1 and 5.8; and orchard grass, 10.5 and 4.7. Ladino clover, in contrast to the other forages, thus maintained a low level of lignin throughout the season. In the other forages, "simulated grazing" prevented the steady increase in

lignin content that occurred when they were permitted to grow undisturbed.

Digestion and grazing trials with steers and wethers established an apparent linear relationship between lignin content of green forages and the digestibility and amount of total digestible nutrients of the forages. Further studies along this line may result in an accurate method for predicting nutritive value of pasturage from its lignin contest.

The lignin ratio in determining intake of nutrients by grazing steers

Seven digestion trials were conducted, alternating two groups of three grade Hereford steers, in which freshly clipped bluegrass was fed. Digestion coefficients were determined in the usual manner and by a lignin ratio technique. (Assuming that lignin is completely indigestible, digestion coefficients may be calculated by use of the ratio of lignin to other components of feed and of feces). Dry matter digestibility and content of total digestible nutrients calculated by the two methods were not significantly different when all trials were considered. In the total series of trials the average recovery of lignin in the feces was 102 ± 7 percent. Grazing trials were conducted concurrently with the first four digestion trials. Dry matter digestibility and content of total digestible nutrients were very similar, as calculated by lignin ratio, whether the forage was fed to steers in the barn or grazed by steers in pasture. From these results it would seem feasible to use the lignin ratio technique in consumption and digestion studies of pasture forages.

Distillers' corn dried solubles versus soybean oilmeal as a protein supplement for fattening steers in drylot

Two similar lots of ten 774-pound good grade western yearling Hereford feeder steers each were fed in drylot for 133 days. Each steer in lot 1 consumed an average daily ration composed of 13.84 pounds of No. 2 yellow shelled corn, 4.85 pounds of low-grade grass hay, and 1.38 pounds of soybean oilmeal testing 41.8 percent crude protein. Each steer in lot 2 consumed an average daily ration composed of 13.36 pounds of No. 2 yellow shelled corn, 4.95 pounds of the low-grade grass hay, and 1.84 pounds of distillers' corn dried solubles which contained 30.4 percent crude protein. The average daily gains per steer were 1.99 and 2.22 pounds, respectively, for the two lots. The steers in the solubles lot showed somewhat higher finish and had keener appetites throughout the experimental period. Apparently, under the conditions of this test, the daily allotment of 1.84 pounds of solubles more than equalled in feeding value the 1.38 pounds of soybean oilmeal and the 0.46 pound of shelled corn.

Distillers' corn dried solubles for pigs

Four lots of ten 80-pound pigs each were fed for 84 days in drylot. All lots were self-fed yellow shelled corn and a mineral mixture of 4 pounds fine-ground limestone and 1 pound salt. Lot 1 was self-fed a protein supplement mixture of 50 pounds tankage, 25 pounds soybean oilmeal, and 25 pounds ground alfalfa hay. Lot 2 was self-fed the same mixture except that soybean oilmeal was replaced by the same weight of distillers' corn dried solubles. Lot 3 was self-fed a protein supplement mixture of 80 pounds soybean oilmeal and 20 pounds of the distillers' corn dried solubles. Lot 4 was self-fed a protein supplement mixture of 50 pounds tankage and 50 pounds of distillers' corn dried solubles. The results were as follows:

	Lot 1 lb	*Lot 2* lb	*Lot 3* lb	*Lot 4* lb
Average daily gain	1.52	1.58	1.60	1.67
Amount of feed per 100 lb gain:				
Corn	308.9	291.8	241.5	258.9
Protein supplement	43.9	56.7	102.8	63.1
Mineral supplement	.8	.8	.7	.7
Total	353.6	349.3	345.0	322.7

These results were closely in line with those of two previous experiments in which the same rations were tested.

Ladino clover and bluegrass pastures in summer for laying hens

A succulent bluegrass pasture was given New Hampshire laying hens from April 7 to June 21 as a supplement to an all-mash laying ration. The hens consumed the growing bluegrass in such quantities that they ate about 20 percent less of the all-mash ration than the control group which had only the mash. On June 21 after the bluegrass had shed its seed and the leaves had turned yellow, one group of hens was continued on the bluegrass pasture and refused to eat it, with no saving in consumption of mash to August 27; another group of hens given access to a Ladino clover pasture saved about 15 percent of the mash during the same time. It was noted that the hens ate only the Ladino clover leaves and a very short upper part of the stems. These parts eaten contained 30.4 percent protein, as compared with 12.9 percent protein in the summer bluegrass. Neither pasture had any apparent effect on the size or hatchability of the eggs laid but both increased the number of eggs.

Quality of eggs frozen and stored for six months

In order to test different types of packaging for freezing eggs, and also to test some recommended means of preventing gelatinization in frozen egg yolks, egg whites, egg yolks, and the whole eggs were frozen in 5- to 8-ounce lots in plain, lacquered, and paraffined tin cans, in glass jars, in paraffined cardboard boxes, and in cellophane sacks, with

and without additions to the yolks of glycerin, corn sirup, and salt. The eggs were frozen in an air-blast type of freezer at -0.2° to -0.4°F. One lot of eggs was tested at the end of 6 weeks and another at the end of 6 months. Custards, angel food cakes, sponge cakes, and plain cakes were made four times from each lot of eggs. Judging was done by a committee who had had either training or previous experience in this work. They scored tenderness, texture, volume, and flavor.

Sponge cakes made with egg yolk frozen and stored 6 months in glass jars, cellophane sacks, and lacquered, paraffined, or plain tin cans were rated definitely higher in flavor, tenderness, and texture than those from paraffined cardboard containers. Cakes made with fresh eggs scored slightly higher in all respects than those made with frozen eggs, probably because all the lots of frozen yolks were more or less gelatinized and it was impossible to obtain a homogeneous mixture even with a mechanical mixer. Yolks to which either glycerin, corn sirup, or salt was added were more homogeneous, and therefore beat up better, than yolks to which nothing had been added. All the sponge cakes scored good or better.

All the angel food cakes were rated good or better. In tenderness the cakes made from frozen whites stored in glass jars ranked highest, followed in descending order, by those made from frozen whites stored in plain tin cans, lacquered tin cans, paraffined tin cans, paraffined cardboard boxes, and cellophane sacks. In texture the cakes made from frozen whites stored in cardboard boxes and lacquered tin ranked highest, and the others, in descending order, were plain tin cans, cellophane sacks, glass jars, paraffined tin cans. Flavor was judged best for egg white stored in plain tin cans and glass jars. Whites from paraffined tin cans and cellophane sacks made cakes a little less desirable in flavor and the lowest score went to those from lacquered tin cans and cardboard cartons. Even the cakes that were rated lowest were still considered good cakes. Frozen whites in general seemed to make the texture of angel food cake slightly more compact than the fresh whites.

Plain cake contained shortening as well as egg yolk and egg white. Flavor was rated good in all the cakes. In tenderness those made with eggs stored in cellophane sacks were rated the best, followed by those stored in paraffined tin cans, glass jars, cardboard boxes, plain tin cans, and lacquered tin cans. In texture the cakes made with frozen eggs stored in glass were rated slightly higher than those stored in cellophane sacks, while those stored in tin or cardboard were rated still lower. The addition of glycerin, sirup, or salt to the yolks seemed to have little or no effect on volume, texture, or tenderness. Salt in the yolks made a slight difference in flavor but it was not named as

"salty" by the judges. The shortening used was unsalted and salt was left out of the recipe when salted yolks were used.

Custards made with frozen eggs stored in the various containers were found to be very much alike in texture, tenderness, and flavor. Yolks to which glycerin was added were rated lower than others because a foam about an inch thick was formed on top of the custard, which made the appearance undesirable.

Egg whites, egg yolk, and whole egg stored in cardboard evaporated to quite an extent. This was the main factor in bringing the score down in the instances where texture, tenderness, and volume were rated low.

Eggs frozen and stored in cellophane sacks were messy to handle. Those stored in tin were convenient to store and use. Eggs in glass were also convenient to use, although it was somewhat difficult to get egg yolk and whole eggs from the shoulder of the glass jar. A glass jar with straight sides and square instead of round would be excellent. Frozen products in over 100 glass jars in this laboratory have suffered no loss from breakage. Gelatinization of the frozen yolks was partially but not completely prevented by the addition of glycerin or sirup or salt, glycerin being the most effective.

Eggs frozen and stored for 6 months were as good in all respects as those frozen and stored for 6 weeks.

Growth and calcification of the sternum and humerus of male and female New Hampshire chickens having straight keels

In 10 New Hampshire chickens killed and dissected at 2-week intervals during the 2nd to 40th week of growth, weight and volume of fat-free dry sternum increased, on the average, more rapidly in female than in male. Increase in specific gravity of dry fat-free sternum averaged about the same in male and female to the 8th week, became more rapid in the male to the 16th week, and then to the 22nd week increased more rapidly in the female. Increase in length of the keel averaged about the same in male and female to the 20th week, then was greater in the male. Ossification of the keel was about the same in male and female until the 12th week, but thereafter was more rapid in the female to the 28th week, when in most instances calcification reached the tip of the sternum. No significant differences were found in rates of growth of the humeri of the male and female until after the 14th week, when the rate of growth in the male became greater. Specific gravity and biweekly increase in length of the humeri averaged nearly the same in male and female to the 28th week, those of the male being consistently slightly larger. The keel was slower to calcify than either the leg bones or the rest of the sternum.

After the 22nd week the specific gravity and percentage of calcium

of the fat-free dry humeri became lower in the female, and after the 24th week the percentage of calcium in the sternum became less in the female than in the male. These changes were probably associated with beginning of egg laying.

Effect of infertility or early death of embryo during incubation, on neighboring eggs

To determine whether infertility or early death in one egg may cause death in neighboring eggs, 10,510 eggs, from six breeds, two different ages of breeding stock, and three experimental farms were set and records of deaths kept. In 20 comparisons, by various classifications, where the number of deaths of embryos in eggs adjacent to eggs in which the embryo had died (all ages of embryos) was compared with the number of deaths adjacent to random samples of other eggs from the same source in the same tray, the number of deaths adjacent to the random samples was greater 15 times. When results were broken down by hatches, location of breeders, age of breeders, breed, incubation treatment, and age at death, 6 out of 39 differences were significant, and in 3 the number of deaths was greater adjacent to the random sample. These results indicate that infertile or dead embryos do not cause death in the embryos in adjacent eggs.

Fiber in chick-starting rations

Five all-mash starting rations, ranging in fiber content from 3.3 percent to 11.0 percent were fed to duplicate groups of New Hampshire chicks. Each successive increase in the fiber content of the ration resulted in a decrease in total gain and feed efficiency to 10 weeks of age. When the ration contained 5.0 percent of fiber, growth and feed efficiency were only slightly inferior to that obtained on a ration containing 3.3 percent fiber. However, growth and feed efficiency of chicks receiving rations containing 7.2 percent or more fiber, were highly inferior to those of chicks fed rations containing only 3.3 percent or 5.0 percent fiber.

These data suggest that for optimum results the maximum fiber content of all-mash starting rations should not exceed 5 percent. Alfalfa meal was used as a source of fiber in these experiments. It is recognized that experiments using other feedstuffs high in fiber, might yield different results.

Control of the northern fowl mite on poultry

Laboratory studies and field tests were made using 40 percent nicotine sulfate applied directly to infested roosters by the drop method, sodium fluoride powder, 10 percent lethane powder, 5 percent DDT powder, 10 percent sabadilla powder, and benzene hexachloride powder of 0.5 percent gamma isomer content. Observations over several months indicated that under field conditions one treatment

with nicotine sulfate usually eliminated the mites completely. The other materials tested gave some relief at first but were only temporarily effective.

Avian encephalomyelitis (epidemic tremor)

The virus of avian encephalomyelitis was isolated for the first time in Kentucky from a group of 12-day-old chicks. It was found to be quite pathogenic for chicks under 2 weeks old and less pathogenic for older chicks. When 9-day-old chicken embryos were injected the disease appeared in the chicks after hatching.

Newcastle disease

During 1947 specimens from 81 flocks of chickens were tested for Newcastle disease, and the disease was detected in 37 flocks. In 6 instances the virus was isolated and identified and in 31 other instances the presence of the disease was established through serum-neutralization tests. These 37 flocks were located in 23 counties in Kentucky.

A combination of Newcastle disease virus and anti-Newcastle serum was injected into 9-day old chicken embryos. A second lot of embryos was injected with sublethal doses of virus and a third lot with anti-Newcastle serum. The injected eggs were allowed to hatch. At 12 days of age these chicks and an equal number of uninoculated control chicks were challenged with active Newcastle disease virus. Mortality was only slightly greater among the control chicks. Injection of serum and virus or virus alone apparently had little effect on the hatchability of the embryos and it did not protect the hatched chicks against a challenging dose of Newcastle disease virus.

In testing the potency of Newcastle disease virus it was found that injecting 12-day old chicks with 10^6 embryo M.L.D. killed 65 percent of the chicks, but that injection of 50-day old chicks with the same amount killed less than 1 percent of the chicks. Approximately 100 young chickens were vaccinated with this virus for use in immunity studies.

Incidence of chicken diseases

Causes of sickness and death among chickens were studied in 283 flocks. In the flocks from which chickens were received for examination 70.5 percent of the disease problems resulted from five conditions: pullorum disease, 34 percent; Newcastle disease, 13 percent; coccidiosis, 9 percent; nutritional disorders, 7.5 percent; and internal parasites, 7 percent. Reducing or eliminating losses due to any of these five conditions requires correct feeding and sanitary precautions. The avian leucosis complex accounted for 6 percent of the losses. A group of 18 other disease conditions embraced 23.5 percent of the diseases diagnosed.

Abortion in mares

In 1947 62 fetuses were received for post-mortem examination. These abortions were diagnosed as virus (20), streptococci (5), twins (9), *Escherichia coli*, staphylococci and torsion of the umbilical cord. In 25 the cause of abortion was not determined.

The incidence of streptococci abortions was lower than in 1946, but that of equine virus abortion was higher. Two of the virus cases studied came from states other than Kentucky. There were no cases of *Salmonella abortus-equi* abortion. *Salmonella abortus-equi* vaccine for treatment of 1235 mares was prepared and dispensed. No case of equine virus abortion was reported in the 518 mares vaccinated in the fall of 1946 with equine virus abortion liver-extract vaccine. This fall (1947) the vaccine was injected into 611 mares, 489 of which were in Kentucky. Where equine virus vaccine was used in outbreaks in 1947 the results were favorable.

Attempts were made to propagate the virus of equine abortion in 9-day old chicken embryos by injecting liver and lung tissue from virus fetuses in combination with sterile horse blood. Sterile horse serum also was used as a vehicle for the inoculum and fertile eggs which previously had been injected with 1 to 2cc amounts of sterile horse blood or serum were re-injected with materials from virus fetuses. Although embryo deaths were greater in eggs injected with virus tissues than in the controls no evidence of virus propagation was obtained.

Guinea pigs injected intraperitoneally with suspensions of liver tissue from virus cases did not show increased temperature nor did they develop liver lesions.

Delayed conception and sterility in mares

The methods used today in handling bands of brood mares were evolved almost entirely from knowledge gained through this research. Early examination for pregnancy makes possible the prompt segregation of pregnant and barren mares. Barren mares then are examined to determine the cause of their sterility. If infected they are treated to return them to breeding condition. This may be done by surgical closure of the upper commisure of the vulva or by proper medication. Mares with abnormal ovaries often are treated with hormones. Occasionally fluid is removed from ovarian cysts by puncture. Very few mares now are regarded as hopelessly infected. It is difficult to estimate the value of this work in terms of foals and money saved for the horse breeders of Kentucky. However, application of the knowledge gained through this research has increased the annual rate of pregnancy in brood mares in central Kentucky about 10 percent. Since there are about 3,000 brood mares in this area it would mean an additional 300 pregnancies each year.

Anthrax

An outbreak of anthrax was diagnosed from blood samples and tissues sent in from Western Kentucky. Four blood samples and animal tissues were examined. Three positive cases of anthrax were diagnosed by guinea pig inoculation and isolation of *Bacillus anthracis*. Two of these cases were mules and one was a cow.

Continuous administration of phenothiazine to horses

Thirteen horses were given free access to a mixture of phenothiazine 1 part, and salt 25 parts. At the beginning of the experiment dilution counts on the feces of the animals revealed strongyloid eggs in numbers ranging from 750 to 6,200 per gram. There was no material reduction of counts in eggs per gram of feces during the first two months of the experiment. Two horses showed significant reduction in egg count at the end of the third month.

Six horses received 2.5 grams of phenothiazine in a ground grain ration over a period of three months. Dilution counts at the beginning of the trial showed strongyloid eggs in numbers ranging from 500 to 3,600 per gram of feces. At the end of the first month the dilution counts were reduced to a range of 0 to 100 per gram and remained at this level during the second and third months. Flotation examinations on the feces at monthly intervals following initiation of daily doses of phenothiazine resulted in recovery of 0 to 9 eggs in duplicate preparations from 20 grams of feces.

Counts on the red and white blood cells and hemoglobin determinations at monthly intervals indicated that there was no toxic action on the hemopoietic system.

Diseases in foals

Foals presented for post-mortem in 1947 totaled 86. The causes of death were listed as *Shigella equuli* (25), streptococci (9), colon-aerogenes (6), equine virus abortion (5), *Salmonella typhi-murium* (3), *Corynebacterium equi*, traumatic injury (5) dystocia (8), hemolytic jaundice (5), ruptured bladder (2), anomalies, and torsion of the intestine. In 15 foals the cause of death was not determined.

In the latter group of 15 foals were several that showed a marked arthritis. For the past few years this condition has been observed in apparently increasing numbers of suckling foals. Foals several months old suddenly become lame and rapidly lose condition. The first symptoms of lameness usually appear in the lower joints but may spread to the hocks, elbows and vertebral joints. Swellings of the pastern, hock, stifle, and elbow joints frequently occur. The symptoms may subside after weeks duration leaving an unthrifty foal with marked exostosis on all diseased joints. Post-mortem findings show erosion of the articular surfaces of these joints and deposits in their

capsules. So far all attempts to isolate the causative agent have failed. Injection of fluid from infected joints into the joint cavities of a normal foal yielded negative results.

Examination of the blood of 6 stallions and 6 mares which had produced icteric foals revealed that the serums of the mares agglutinated the erythrocytes of the stallions and that the serums of the stallions did not agglutinate the erythrocytes of the mares. Serums from a number of other horses did not agglutinate these stallion's cells.

Sodium fluoride for ascariasis of horses

Preliminary dosage trials were made on two adult horses to determine toxicity and possible anthelmintic activity against ascarids. One horse weighing 1,000 pounds was given 2.5g NaF per 100 pounds of body weight with a stomach tube and was killed 24 hours later. No inappetence or depression followed administration of the 25g sodium fluoride. Post-mortem examination showed no evidence of gastric or intestinal inflammation.

Another horse weighing 1,300 pounds was given 5g sodium fluoride per 100 lb body weight, a total of 65g. This animal developed anorexia and marked depression after 6 hours, and a watery diarrhea within 24 hours following treatment. After euthanasia at 36 hours catarrhal and hemorrhagic gastritis, and catarrhal enteritis were found. The kidneys and liver were slightly swollen and the spleen contained hemorrhagic infarcts. Ascarids were not found in either horse. There was apparent action of the sodium fluoride against the small roundworms in the cecum and colon.

In-vitro sensitivity of *Shigella equuli* cultures to penicillin and streptomycin

The in-vitro sensitivity to penicillin and streptomycin of 24 cultures of *S. equuli* was determined by streaking on agar plates containing known amounts of each entibiotic. The medium was horse meat infusion agar with a pH of approximately 6.8. The inoculum was one 5 mm loop of a 24-hour culture in tryptose broth. Twenty ml of medium was used in each plate and readings were made after 24 hours incubation at 35°C.

Three cultures were inhibited completely and all cultures partially inhibited by 4.0 micrograms of streptomycin per ml of medium. Ten cultures were inhibited completely by 8.0 micrograms per ml with the remaining 14 growing as pin-point colonies. With two cultures there was pin-point growth of a few colonies with 16.0 micrograms per ml.

Four cultures were inhibited completely and all cultures inhibited partially with 1.0 unit of penicillin per ml of medium. With the exception of two strains which showed pin-point growth, all cultures were inhibited completely with 2.0 units per ml of medium.

Water-in-oil emulsion vehicles for penicillin

Pendil, improved formula, containing cholesterol derivative, 11 parts, and peanut oil 20 parts W/V, with beeswax 2 percent W/V, was tested for efficiency in delaying absorption and prolonging a measurable blood level of penicillin following intramuscular injection in horses. With 100,000 units of penicillin in the 1.0 ml of saline emulsified in 3.0 ml of pendil, using dosages of 500 units per pound of body weight, the preparation was found to maintain serum levels of approximately the same concentration and duration as those obtained with the Romansky formula. With this dose the material was somewhat irritating, apparently because of the mass of the dose. Reducing the quantity of oil and wax in the emulsion apparently alleviated most of the irritation, but this resulted in a blood level duration only slightly better than that obtained from saline solution.

Another product, Penol, containing oxycholesterol in vegetable oil was found to be only slightly superior to saline solution.

Salmonella and paracolon bacteria

Of 2,009 cultures examined 1,322 were from animals and 687 from man. Of these, 1,087 animal cultures and 531 from man were *Salmonella* strains identified by serologic methods. Of 71 cultures of the Arizona group, 62 were from animals and 9 from man. The strains of human origin were from a large outbreak in hospital personnel, the first recognition of Arizona strains in mass infection of man. Four new *Salmonella* types were recognized: *S. texas* (IV,XII: k-e,n,z_{15}), and S. Marseille (XI:a-1,5), S. hidalgo (VI,VIII:r-e,n,z_{15}) and S. *mission* (VI,VII:d-1,5).

In continued studies on the phylogeny of *Salmonella* it was found that *S. minnesota* (XXI,XXVI:b-e,n,x) sometimes occurred naturally in a form which changed H antigens (XXI,XXVI:z_{33}). This is the first instance in which 3 phases have occurred naturally in the same *Salmonella* type. *S. simsbury* and *S. senftenberg* were each transformed into the other by induced variation, indicating that both types arose from the same ancestor. By induced variation it was possible to change 1,2 phases to 1,2,3 and vice-versa. This resulted in the omission of antigen 3 from the Kauffman-White classification. It was also proved that 1,10 and 1,11 phases arose from 1,5 phases, so that these antigens also were dropped from the classification.

Sucrose-fermenting paracolon cultures having the *Salmonella* formula VI,VIII:d,i were changed to VI,VIII:i and VI,VIII:j. These cultures provided excellent antigens for production of i serums. Similar cultures having the formula IV,XII:d,e,h were changed to IV,XII:d, IV,XII:e,h, and VI,XII:e,n,z_{15}. These forms also were satisfactory for production of diagnostic serums.

Residual phosphorus in soil after heavy application of rock phosphate and superphosphate

Residual effects of phosphate fertilizers on crop yields and availability of soil phosphorus at the Campbellsville Soil Experiment Field were reported last year. This year chemical tests were made of the acid-soluble, total, and replaceable phosphorus in samples collected from these plots in 1931, 1938, and 1946. These values were compared with the amounts of phosphorus applied and the estimated amount removed by crops.

Total and acid soluble phosphorus decreased steadily in check plots and plots where fertilizers were discontinued in 1931. Where superphosphate has been used continuously at the rate of 16 pounds of P_2O_5 per acre per year, there has been a slight increase in total phosphorus and a slight decrease in available phosphorus. On plots that received a large amount of phosphorus before 1931 but have received none since, there has been a marked decrease in both total and available phosphorus. This decrease was more rapid during the first 7 years than during the last 8 years. The outgo from these plots has averaged about 10 pounds of phosphorus per acre per year. On corresponding rock phosphate plots the analyses revealed the same trend, but as four times as much phosphorus had been applied, differences were greater. The outgo of phosphorus from these plots for the same period has averaged 16 to 18 pounds per acre per year instead of 10. These results corroborate studies with crop plants which showed that the amount of phosphorus taken up by the plant is governed by the kind and amount of phosphate fertilizer used. A small part of the outgo of phosphorus in this study may have been due, however, to phosphorus being carried down into lower soil layers by mechanical means. A slight amount may also have been lost by erosion, though erosion is believed to be only a minor factor in this study.

Residual effect of superphosphate and rock phosphate

At the Greenville Experiment Field superphosphate was used from 1913 to 1929 at rates to supply a total of 432 pounds of P_2O_5 per acre in one set of plots, while rock phosphate was used on another set to supply a total of 1,728 pounds of P_2O_5 per acre during the same period. Both sets of plots were limed and received manure. The two treatments at the time these applications were made were about equal in cost, but the price difference in the two materials at present is considerably less than the 4-to-1 ratio used. In 1929 each plot was divided. On half of each plot the phosphate applications were continued while on the other half no more phosphate fertilizer has been added. The average yield of wheat, corn, and hay during the latest round of the rotation (1944-7) are shown in the following table:

	Corn bu	Wheat bu	1st year Hay lb	2nd year Hay lb
Manure, limestone, superphosphate				
Continued	64.4	25.5	6635	4910
Discontinued, 1929	59.5	13.5	4700	3675
Manure, limestone, rock phosphate				
Continued	63.7	22.5	6370	5185
Discontinued, 1929	62.5	20.6	5696	4675

Yields of all crops were less on the plots where phosphate applications were discontinued than on those where the applications were continued, but the drop in yields where superphosphate was discontinued was much greater than where rock phosphate was discontinued.

Effect of liming on availability of rock phosphate

In a comparison of rock phosphate on limed and unlimed land at the Campbellsville Experiment Field, 4 tons of ground limestone were applied to the limed plot between 1919 and 1924. As measured by crop yields, the effect of the limestone was to reduce the availability of the phosphorus during the early years of the rotation. For the first five rounds of the 3-year rotation, the plot treated with limestone and rock phosphate yielded less than the plot treated with rock phosphate without limestone. Since the fifth rotation, yields have been better on the plot treated with rock phosphate and limestone. These results indicate that when rock phosphate is used, just enough limestone should be applied to grow the desired legumes.

Size of clay particles in Pearman and Maury soils

Clay particles below 2 microns in size were separated from the Pearman and Maury soils by gravity sedimentation, using calculations based on Stokes law to determine the rate of sedimentation. Clay particles between 2.0 and 1.0 micron were also separated by gravity, but below this size separations were made by means of the Sharples Supercentrifuge. Calculations of particle size were based on an equation of Hauser et al at Massachusetts Institute of Technology. The clay was separated into the following fractions: 1.0 to 0.2, 0.2 to 0.1, 0.1 to 0.05, and less than 0.05 microns. These fractions were checked by means of an electron microscope and found to be very close to the values as calculated.

Nearly half of the clay in both soils fell within the 1.0 to 0.2 micron fraction, and only 3 to 8 percent fell in the fraction less than 0.05 micron. Percentage distribution of sizes in both soils was very close in spite of the fact that the Maury soil contained over 25 percent total clay and the Pearman soil contained only 16 percent.

Removing free iron and aluminum oxides from the Pearman soil caused a slight decrease in percentage of total clay and an increase in the percentage that fell within the finer fractions (0.1 to 0.05, and less than 0.05 micron).

Size of clay particles in relation to their chemical composition and reactivity

Total chemical analysis of clay fractions shows great change in chemical and colloidal properties as particle size decreases. Hygroscopic and bound water increased markedly as particle size decreased. Silica decreased to a minimum in the two fractions from 0.2 to 0.05 micron and then increased again in the finest fraction. Aluminum increased to a maximum in the same fractions and decreased again in the finest fraction and the silica; iron and aluminum ratio decreased in the same order as silica and increased again in the finest fraction. This change in composition may give some indication of a change in mineral composition of the finest clay fraction.

Base exchange capacity of the various fractions was almost inversely proportional to particle size. Total base exchange capacity of the finest fraction of the Pearman soil was nearly 50 m.e. and of the Maury, 75 m.e. per 100 grams of clay. These high capacities point strongly to a predominance of 2:1 lattice type of clay mineral in the finer fractions. Phosphorus fixation by the various fractions was also nearly inversely proportional to particle size of clay down to 0.1 micron.

Electron microscope and X-ray diffraction studies of Pearman and Maury clay fractions

Electron micrographs were made of the clay fractions of different particle sizes from Pearman and Maury soils, the particles being magnified to 13,500 diameters. These micrographs were then compared with published micrographs of pure clay minerals. These comparisons indicated that the coarser clay fractions (above 0.2 micron) were made up predominantly of 1:1 lattice type of clay minerals resembling kaolinite and dickite most closely. The finer clays resembled 2:1 lattice type of clay minerals more closely, a conclusion confirmed by preliminary x-ray diffraction studies as well as chemical analysis.

Disappearance of burley tobacco by groups of grades

Estimates of the total annual disappearance of burley tobacco have been possible since 1913 but a break-down of this total by groups, grades, or qualities was not possible until special stocks reports for burley were begun in 1936. Stocks by groups and qualities are reported quarterly on January 1, April 1, July 1, and October 1. By calculating the change in stocks from April 1 to October 1 of each year an estimate of disappearance during the six months can be made, and, on this basis, trends during the 12 years since 1936 can be shown by comparing the first six years with the last six years:

Group	1936-41 (1000 lb)	1942-47 (1000 lb)	Net Change, Percent
Bright Leaf	19,424	25,242	+30.0
Lugs	55,374	82,509	+49.0
Flyings	35,858	43,181	+20.4
Total smoking groups	110,656	150,932	+36.4
Red Leaf	20,510	23,414	+14.2
Tips	20,822	28,626	+37.5
Total filler groups	41,332	52,040	+25.9
Other groups	2,606	1,960	−24.8
Total, all groups	154,594	204,932	+32.6

(In the above figures stocks are adjusted for loss in stemming, but not for redrying. Figures for tobacco of farm-sales-weight would be about 1.12 times these.) Disappearance of those groups which in general go into cigarettes and smoking tobacco increased over 36 percent, while disappearance of the heavier grades increased only 26 percent. This probably reflects a change in production practices, to emphasize these grades, as well as a change in consumption. No pronounced trends in the use of different qualities of tobacco within these groups seems apparent, however.

Effect of potash on yield and value of burley tobacco

At the Greenville Experiment Field three adjoining plots of burley tobacco received equal amounts of ammonium nitrate and superphosphate, but different amounts of sulfate of potash. The treatments, average yields, value per 100 pounds, and value per acre for the 1945 and 1946 crops were as follows:

Per-Acre Treatment (N - P - K)	Acre-Yield lb	Value per 100 lb	Value per Acre
60 - 60 - 0	1184	$26.74	$316.56
60 - 60 - 60	1402	38.53	540.18
60 - 60 - 120	1617	42.85	692.82

The tobacco grown on the 60-60-0 plot showed very decided potash starvation both years.

Effect of nitrogen fertilizer on yield and value of burley tobacco

In 3 years of experiments at the station farm at Lexington, plots of burley tobacco were fertilized with ammonium nitrate to supply 50, 100, 150, and 200 pounds of nitrogen per acre. Check plots received no nitrogen application. All plots, including the checks, were uniformly treated with potash. No phosphorus was applied, because the soil was highly phosphatic. As an average for the 3 years, yields increased with each increase in amount of nitrogen added, but the amount of increase per pound of nitrogen added declined with the larger additions. Total value of leaf per acre increased with each increase in amount of nitrogen added up to 150 pounds nitrogen per acre. Addition of 200 pounds nitrogen per acre gave no appreciable increase in value of leaf over the addition of 150 pounds nitrogen.

Priming and time of cutting burley tobacco

Two years of experimental data from priming studies on 7 central Kentucky farms (1945 and 1946) indicate that priming one or two times pays over $1 per hour of extra labor required to prime. The increase per acre was $105 for tobacco primed once and $184 per acre for tobacco primed twice, as compared with the usual time and method of harvesting tobacco. The tobacco was graded and valued according to the average prices in 1945-6 and 1946-7. All labor for each method of harvest was timed and adjusted to the average labor requirements for the state.

The additional returns brought about by priming were due to increase in yield and quality. The higher yield occurred in that primed leaves lose less dry weight in curing than stalk-cured leaves; and, in addition, priming saved leaves that are ordinarily lost during harvest. The stalk-cut portion of primed tobacco was of higher quality due to the fact that the leaves were more mature at harvest, and saving the lower leaves raised the general quality of the crop. Of the tobacco that was primed one or two times 88 percent went into smoker quality (flyings, lugs, and tan leaf), whereas only 74 percent of the unprimed tobacco harvested at the ordinary stage of ripeness was smoker quality.

The labor requirement for stalk cutting and housing was lower on tobacco that had been primed. Priming reduces the length of the part housed, by allowing the plant to be cut higher above the ground, and thus makes the plants easier to cut and house. Priming also reduces the time necessary to strip the crop, this saving being an offset against the extra labor in removing the leaves from the plant.

In comparison with harvesting at the usual time and in the usual way, 60 extra hours of labor were required to prime once, 100 extra hours to prime twice, and about 160 extra hours to prime three or four times. Harvesting with four primings took no more total labor than with three, because four primings took all the leaves and the labor of the stalk-cutting, housing, and later stripping was saved.

Meadow nematodes and brown root rot of tobacco and other crops

Meadow nematodes were found not only in the roots of tobacco and other crop plants during the summer, but were found in large numbers throughout the winter in the roots of grasses, various legumes, and small grains. Spring-seeded red clover plants examined in June had up to 537 meadow nematodes in a single root system, suggesting that they may be an important factor in the red clover root-rot problem and in red clover failure. Meadow nematodes have been found so far in the roots of tobacco and other crop plants making poor growth in 14 Kentucky counties, but they probably are present in many other

counties also. In a count of meadow nematodes in the roots of tobacco plants grown on two plots, one of which had received sulfur several years ago (pH 5) and one of which had received lime (pH 6.5), very few were found in the sulfur plot and large numbers in the limed plot. Several plots were treated with D-D mixture (dichloropropane and dichloropropylene) and with ethylene dibromide in the spring, after plowing under a sod. Treatments with these materials on sandy soils have proved highly effective in reducing nematode numbers, but on the sodland at the Station Farm at Lexington they had relatively little effect, perhaps because the sod was not sufficiently broken up to allow good penetration.

Burley tobacco varieties highly resistant to black root rot and mosaic

Thirteen new varieties of burley proved highly resistant to black root rot in 1947 under conditions exceptionally favorable for development of this disease. These varieties are also resistant (NN) to mosaic.

Burley tobacco varieties with Ambalema factors for resistance to mosaic

In attempts over the past 13 years to develop satisfactory mosaic-resistant burley varieties carrying the resistance factors from Ambalema many varieties highly resistant to both black root rot and mosaic have been developed, but nearly all have had undesirable leaf shape and were subject to severe wilting and scalding in hot weather. One variety, however, is distinct from the others, and more promising than they. It is of the stand-up type, is highly resistant to black root rot and mosaic, and for the past 3 years has shown no signs of wilting or scalding. It is possible that, by crossing over, the scalding factor has been eliminated and that this variety may be used in the production of satisfactory mosaic-resistant varieties.

Burley tobacco varieties resistant to wildfire and other diseases

Early in 1946 a cross was made between burley tobacco and *Nicotiana longifora*, the latter being the pollen parent. By colchicine treatment of the few viable seeds, fertile hybrids were obtained, some of which were highly resistant to wildfire and angular leaf spot. Since that time the third backcross generation has been grown and an appreciable number of plants selected that are typical burley and seem to be as highly resistant to wildfire as N. *longifora*. The backcross parents used were of two kinds—those resistant to black root rot and mosaic, and those resistant to these diseases and to fusarium wilt. The end products should be varieties resistant to three or four diseases.

Dark tobacco strains resistant to black root rot and mosaic

Progress is being made in the development of dark fire-cured and one-sucker varieties of tobacco that are highly resistant to both black root rot and mosaic (NN). The best of these are being used in crosses on wildfire-resistant tobacco in an attempt to develop varieties resistant to mosaic, black root rot, and wildfire.

Burley tobacco varieties resistant to fusarium wilt

Thirty-one new burley varieties, all resistant to black root rot, mosaic (NN), and fusarium wilt, were tested at the Station and with farmers over the state to find one or more that would stand in windy, wet weather. One of these—F 17A, 46—stood up well and produced an excellent yield of good quality tobacco. It and a few other selections will be more extensively tested in wilt-sick soils in 1948. One of these should rapidly replace Ky 33, which is being dropped from the list of certified varieties, because during the exceptionally cool weather of the summer of 1947 it proved to be too susceptible to black root rot.

Low-nicotine tobacco, Type 31V

In 1933 a project was started on the development of a low-nicotine cigarette tobacco that could be smoked without the injurious effects that are attributed to nicotine. By backcrossing burley on burleylike derivatives of a cross of German low-nicotine cigar tobacco and burley, varieties have finally been developed that have the appearance of burley but a different aroma. The cured leaf contains approximately 0.3 percent total alkaloids in the form of nicotine and nornicotine. During curing the nicotine appears to change nearly completely to nornicotine. This low-nicotine tobacco has recently been recognized as a sub-type of burley tobacco and designated by the U. S. Department of Agriculture as Type 31V. It has been grown on a small scale commercially during the past 3 years for the purpose of manufacturing low-nicotine cigarettes, cigars, and pipe tobacco.

Other strains of tobacco have been isolated that contain about 1.5 percent total alkaloids, of which nearly all remains as nicotine.

An inhibitor of streak virus in tobacco

In testing tobacco plants for streak resistance by inoculating with crushed streak-infected leaves of *N. rustica* with M/10 Na_2HPO_4, large numbers of necrotic local lesions are ordinarily produced, but at times the number produced is small. It was found that the more thoroughly the leaves were crushed in preparing inoculum the smaller the number of lesions. Addition of juice from healthy *N. rustica* or *N. tabacum* to the inoculum also reduced the number of lesions. The nature of the inhibitor is not known.

Insects as possible vectors of streak virus

Observations indicate that some insect is the vector of the streak virus. Various species of leafhopper were collected from sweet clover on the Experiment Station farm and in Harrison county, and placed on tobacco plants in cages. In all, twelve species were tested. In no case did streak develop. This negative result, however, does not eliminate leafhoppers as the possible vector.

Reaction of additional varieties of tobacco to streak

Two hundred and sixty additional accessions of tobacco, a total of 460 varieties (T. I. collections) were tested for resistance to streak virus but none proved sufficiently resistant to offer promise as breeding stock. It appears from these results that it will be necessary to look to other species than *N. tabacum* for resistance to this virus. The second backcross generation of amphidiploid of *N. glauca* x *N. tabacum* with burley tobacco is being tested for resistance to streak, and some burleylike plants give promise of being resistant.

Cost and income in producing corn

For a group of farms using tractors in southwestern Kentucky, producing average corn yields of 46 bushels per acre, the labor and power requirements were 12.8 man-hours, 9.1 horse-hours, and 5.6 tractor-hours per acre. When compared with requirements on farms using horses in the same area this was a reduction of 8.7 man-hours and 16.7 horse-hours per acre. On most of the farms having tractors, horses were used in planting and harvesting, and on the farms where horses were used chiefly, tractors were used for breaking and disking in some cases, mostly on a custom basis.

Among a group of 28 tractor-using farms in southwestern Kentucky on which corn production averaged 87 bushels per acre, about 2.2 more hours of man labor were required per acre than on similar farms producing average yields (46 bushels). The additional labor was used principally in spreading fertilizer and manure, and in harvesting the crop.

In 1946 costs of production per bushel, not including a charge for use of land or cost of cover crop, averaged 39.5 cents for a group of farmers who obtained high yields as compared with 48 cents for a typical group producing average yields. More fertilizer and manure were used by the high-yield group. The fertilizer used was equivalent to about 500 pounds of 6-8-6 and 200 pounds of 20-percent phosphate per acre. This was about 400 pounds of 6-8-6 and 100 pounds of 20-percent phosphate more than the average amount used per acre on the farms where yields were only average. In addition more plants per acre were grown by the high-yield group, and the land was probably more productive than on the average-yield farms.

A comparison of labor and power requirements for harvesting corn

was made between farms harvesting the corn by hand from the standing stalk and those using mechanical corn pickers. Farmers harvesting by hand used on the average 8.7 man-hours, 12.8 horse-hours, and no tractor hours per acre in harvesting corn, while those using the pickers required only 3.2 man-hours, 2.0 horse-hours, and 1.6 tractor-hours.

Yields of hybrid and open-pollinated corn

Twelve white hybrids and 9 yellow hybrids were grown in comparison with Boone County White and Reid Yellow Dent, open-pollinated varieties, in yield tests in Fayette, Todd, Caldwell, Breathitt, Madison, Daviess, Fulton, and Jefferson counties. The average yield of the 23 varieties for all locations was 65.0 bushels per acre. Except for too much moisture in some locations, the season was favorable for corn average yields being:

	Bushels per Acre
Fayette county	86.8
Todd county	77.0
Caldwell county	53.2
Breathitt county	59.9
Madison county	45.1
Daviess county	67.4
Fulton county	38.5
Jefferson county	98.4

The white hybrids averaged 68.4 bushels per acre, which was 18.9 bushels (38.2 percent) more than Boone County White. The yellow hybrids averaged 63.5 bushels per acre, which was 10.0 bushels (18.7 percent) more than Reid Yellow Dent. The two white hybrids grown commercially in Kentucky out-yielded Boone County White 36.2 percent; they ranked 10th (Ky72B) and 13th (Ky203) while Boone County ranked 22nd. The three yellow hybrids grown commercially out-yielded Reid Yellow Dent 21.9 percent, ranking 8th (Ky103), 17th (US13), and 18th (Ky102), while Reid Yellow Dent ranked 21st.

The experimental white hybrids Ky405B, Ky408, and Ky410 were again higher yielding than the two commercial hybrids grown, and they stood up much better. Ky418, tested for the first time in state-wide tests, was high yielding but late maturing. Indiana hybrids 750A and 901A were again among the highest yielding hybrids, ranking 1st and 3rd, respectively, as an average for all tests. Indiana 750A is early maturing, low growing, and stands up well. In the yellow hybrids Ky158, Ky174, and Dixie 44 again compared very favorably with the three yellow commercial hybrids grown. Ky180, tested for the first time in state-wide tests, showed much promise.

Performance of new corn hybrids.

With very favorable performance of Ky405B (white) and Ky158 (yellow) over a 3-year period in state-wide tests, these hybrids were distributed to Kentucky farmers in 1947 for commercial tests with the leading commercial hybrids. The tests were in field plots ranging from

1 to 5 acres. Reports were received from 9 counties comparing Ky405B and from 15 counties comparing Ky158. While there was some variation in individual counties, as an average for all these tests Ky405B yielded 0.7 bushels less than Ky203 and Ky158 yielded 1.4 bushels more than Ky103. Differences in standability were very slight. In the uniform plot tests conducted in the various locations for the past 3 years both these new hybrids have stood up better than the commercial hybrids being certified and have been more uniform.

Indiana 750A, grown in the statewide tests for 2 years, has performed very favorably. It is early maturing and stands up well for harvesting mechanically.

Yields of commercial corn hybrids

Tests of commercial hybrids and varieties sold and grown in the Pennyroyal district were continued in Todd county in cooperation with the Pennyrile Grain Improvement Association. Thirty hybrids and varieties were included in the test in 1947, the average yield of all entries being 66.0 bushels per acre. There was no significant difference in yield in the top 13 hybrids. The 7 white hybrids included in the test averaged 65.3 bushels per acre, and the 21 yellow hybrids averaged 68.2 bushels per acre. White Prolific and Yellow Prolific, open-pollinated varieties, yielded 52 percent and 42 percent less than the white and yellow hybrids, respectively. In general higher yields were obtained with the earlier maturing hybrids in contrast with higher yields generally with the later maturing hybrids in 1946. Yellow hybrids performing satisfactorily both years were US13, Ky103, Pioneer 300, Princeton Farms 818, DeKalb 817A, and Funks G94. White hybrids high in yield both years were Ky203, Tenn. 10, Funks G515W, and Princeton Farms 901B. Seed of the same hybrid from different sources varied in yield again in 1947.

Hybrid popcorn

Tests of popcorn hybrids in commercial use in Indiana were continued at Lexington and Owensboro in comparison with South American and Supergold open-pollinated varieties. Yields at Lexington averaged 4,991 pounds of ear corn per acre, and at Owensboro 2,607 pounds. The hybrids yielded 15.3 percent more than the open-pollinated varieties at Lexington and 21.3 percent more at Owensboro. Purdue 31 was the highest yielding hybrid in both locations with Purdue 32 and Purdue 38 continuing high in yield. Purdue 32, Purdue 38, and Purdue 3 have been high yielding over 3- and 4-year periods at Lexington while Purdue 31 has been high yielding (2-year averages) at both locations.

Male sterility in corn hybrids

The study on "Scattergrain" white corn hybrids conducted in cooperation with the U. S. Department of Agriculture and reported

in 1946 was continued in 1947 with extensive experimental plantings at Lexington and Owensboro, Kentucky, and at Beltsville, Maryland. Data obtained on these experimental hybrids show that male sterility, resulting in poor seed set from insufficient pollen, will occur in crosses which have a cytoplasmic contribution from 33-16 and possibly in those having a similar contribution from Ky27. It is probable that other inbred lines may carry similar cytoplasmic contributions for sterility as several commercial hybrids have been reported to be involved and extensive losses have resulted in some fields. Sterility also is influenced by certain contributions from the male parent, a minimum of two genes apparently being required. A number of white inbred lines seem to carry at least one of these genes and K63 and Mo2RF apparently carry both. The expression of sterility is subject to environmental influence.

Pre-emergence control of weeds in corn with 2, 4-D

In tests at the Station farm, application of 2,4-D chemical to the soil of planted corn plots, 2 or 3 days before the corn came up, inhibited growth of weeds and grasses for 6 or 7 weeks without injuring the stand or growth of the corn. Occasional weeds and grasses started up after the sixth week, but they grew so slowly in the rapidly developing corn crop as to offer little competition, and no cultivation was required.

The ammonium salt of 2,4-D, at the rate of 2.7 pounds of 2,4-D acid mixed with 160 gallons of water per acre, was sprayed on one plot, and 3.5 pounds of 2,4-D acid per acre as the dust in mixture with sand was applied broadcast on other plots. The two methods of application were about equally effective in preventing weed growth.

As a check, the weeds in one plot were controlled by hand scraping with a hoe. On some plots corn was cultivated in the usual manner, and on other plots the weeds were allowed to grow uncontrolled. The corn, Ky102 planted on a thoroughly prepared seedbed June 23, grew off rapidly during the very favorable season, whereas the weeds came up and grew slowly even where no attempt was made to control them.

The yields of corn for the various methods of weed control are shown as the percentage of check plot yield:

Method of control	*Yield, percent of check plot*
Hand scraped with hoe (check plot)	100
Yield per acre 94 bu shelled corn (15.5% moisture)	
2,4-D pre-emergence spray application	111
2,4-D pre-emergence dust-sand application	100
Cultivated twice with machine cultivator	92
Weeds uncontrolled	89

Post-emergence control of weeds in corn with 2, 4-D

Applications of 2,4-D effectively controlled weeds in corn tests at the Station farm, 2,4-D in the form of sodium salt and ammonium

salt was applied at the rate of 3.0 pounds of active 2,4-D acid per acre, and triethanolamine salt and butyl ester were applied at the rate of approximately 1.2 pounds 2,4-D acid per acre. All materials were applied in solution at the rate of 160 gallons per acre.

In late-planted corn that was not cultivated and was 4 to 5 inches tall when sprayed, pigweed, ragweed, lamb's-quarters, and wild morning-glory were dead 9 days after treatment. Butyl ester gave the most rapid kill of weeds but also injured the corn more than the other treatments. In this plot the corn was paler, had narrower leaves with some wilting and lodging of the plants at the ground level. The stand was reduced to 80 percent of the check plots. In later development there was considerable stimulation of brace root development and a high percentage of the stalks were barren. A small amount of damage developed in the corn sprayed with sodium salt and ammonium salt while there was no visible damage to the corn sprayed with 2,4-D in the form of amine salt. The yields of corn grain were 106, 132, 62, and 130 percent of the adjacent check plots for the plots sprayed with sodium salt, ammonium salt, butyl ester, and amine salt, respectively. In applying the material on corn this small it was impossible to keep the spray from getting into the leaf whorl. It should also be pointed out that the applications were much heavier than was necessary for effective control of the weeds.

In early-planted corn that had been cultivated the applications were made at the side of the row when the corn was 4 to 5 feet tall. After 9 days pigweed, ragweed, lamb's-quarters, and wild morning-glory were completely dead while swampgrass was suppressed so as to offer little competition with the corn. There was no apparent injury to the corn from any of the materials. The yields of corn grain were 117, 116, 121, and 112 percent of the adjacent check plots for the plots sprayed with sodium salt, ammonium salt, butyl ester, and amine salt, respectively.

Control of wild garlic and wild onion with 2, 4-D

In tests at the Station farm wild garlic was prevented from producing aerial bulbs in bluegrass pasture and in a ryefield, and stands of garlic plants were reduced with heavy applications of 2,4-D. Applying 2,4-D in the form of ethyl acetate and butyl ester at the rate of 1.15 and 2.3 pounds of 2,4-D acid per acre and in the form of sodium salt at the rate of 2.3 pounds 2,4-D acid per acre prevented the garlic plants from producing seed heads. A few plants produced seed heads in the plots sprayed with ammonium salt of 2,4-D and in the plots receiving the light application in the form of sodium salt. Seed heads were produced freely in the check plots. In all treated plots the stand of garlic plants was reduced as much as two-thirds, and in some plots sprayed with heavy applications of ester the stand was reduced to only a few plants. The treatment was especially effective in reducing the number

of old plants but was not effective in killing plants emerging from hard-shelled bulbs or those germinating after the treatment was applied. Repeating the treatments the following year reduced the stand of garlic plants further and in plots treated with 2,4-D acid in the form of ester the plants were nearly completely eliminated. Single applications in early April were as effective as successive treatments in January, February, March, and April. There was no apparent difference in effect in bluegrass plots that were not grazed and in those grazed continuously.

No apparent injury to the bluegrass was observed and only a few rye plants were distorted,though no record of seed yield was obtained. A few orchard-grass plants growing in the bluegrass pasture appeared to be affected from the treatment but they soon recovered and grew normally.

A single plot heavy with wild onion was sprayed in late April with 2.3 pounds per acre of 2,4-D acid in the form of ester. In early June all onion plants were dead and no plants emerged in the fall. Wild onion is apparently much easier to kill than wild garlic.

Rates of planting corn

Two rates of planting corn were compared at Greenville in 1944 and at Mayfield in 1946 and 1947. Half of each plot had 2 stalks per hill, and the other half 3 stalks per hill. At Greenville the hills were 42 inches by 42 inches and at Mayfield 40 inches by 42 inches. Severe drouth held down yields at Greenville in 1944. At Mayfield the moisture conditions were unusually favorable in 1946 and somewhat less favorable in 1947. The heavier rate of planting was an advantage on the more productive soil when rainfall was plentiful, but was a disadvantage in a drouthy season or on unproductive land. Average yields of ear corn, in bushels per acre, were as follows:

	3 stalks per hill	*2 stalks per hill*
1944, average of 18 plots	31.3	41.4
1946		
Average, 13 plots yielding over 80 bu	94.2	82.0
Average, 9 plots yielding less than 80 bu	69.9	65.9
1947		
Average, 13 plots yielding over 40 bu	53.5	52.4
Average, 9 plots yielding less than 40 bu	27.7	32.9

DDT-impregnated bags for protecting stored corn from insects

DDT dissolved in carbon tetrachloride was used to impregnate cotton bags in which insect-free corn was stored. The bags were dipped in or sprayed with solutions containing 2½, 5, and 10 percent DDT. Large and small cotton bags were used, and untreated bags were used for comparison. Eight bags were treated with each of the 3 solutions and 8 were untreated. Six months after treatments, the percentages

of damaged grain were 8 percent in bags treated with the 2½-percent solution, 2.9 percent in bags treated with 5-percent solution, and 1.5 percent in bags treated with the 10-percent solution. Thirteen months after treatment, the averages were 11.7 percent of grain damaged in bags treated with the 2½-percent solution, 3.3 percent in bags treated with the 5-percent solution, and 1.9 percent in bags treated with the 10-percent solution. Practically all grain in untreated bags was damaged at the end of 6 months.

Abundance of European corn borer

In general, there was some increase in the corn borer population in the Bluegrass Region of Kentucky. Fall surveys in Fayette and Woodford counties indicated an average infestation per 100 stalks of 188 and 415 borers respectively. A similar survey in Nelson county indicated an average infestation of 198 borers per 100 stalks in the northern two-thirds of the county.

On the Experiment Station farm, at Lexington, first-brood corn borers in the earliest planted field corn were much more abundant than in any previous year. Second-brood borers, however, were fewer than in 1946 probably because of heavy parasitism by *Lydella* and because only about 20 percent of the first-brood borers pupated this year, compared with 30 to 45 percent in 1945 and 1946 and 97 percent in 1944.

European corn borer parasites

In 1947, in cooperation with the federal Bureau of Entomology and Plant Quarantine, 6,936 specimens of 4 species of European corn borer parasites were released in Kentucky. These were *Eulophus viridulus* Thoms., *Horogenes punctorius* (Roman), *Lydella stabulans*, var. *grisescens* R. and D., *Macrocentrus gifuensis* Ashm. Releases were made in Bourbon, Boyle, and Warren counties. A survey made during the fall of 1947 to determine parasite spread from the Fayette county releases of former years indicated that the parasitic fly, *Lydella stabulans* var. *grisescens* R. and D. had spread at least 6 miles in all directions from Lexington. On the Experiment Station farm, in one large planting of early field corn, this parasite destroyed 55 percent of the borers.

Relation of date of planting corn to European corn borer infestation and damage

Plots of 8 kinds of corn (Ky72B, Ky203, Ky105B, U.S.13, Ky102, Ky103, Ky158, and Tr.X38-11) were planted on May 7, May 23, and June 5 and each series of plots was replicated 5 times. Counts were made of first- and second-brood corn borer, leaf damage, and breakage due to borers. Dissections of stalks in late July indicated that corn in the May 7 planting averaged 0.9 to 2.1 corn borers per stalk, while

corn planted May 23 averaged 0.1 to 0.8 corn borers per stalk. Only one borer was found in 80 stalks of corn planted June 5. Other dissections made in the fall to determine total borer infestation gave an average of 0.8 corn borers per stalk for the May 7 planted corn, 0.97 for the May 23 planted corn, and 0.71 for the June 5 planted corn, indicating that the May 7 planting was not attractive to second-brood borers. At harvest, breakage below the ear due to corn borer was 7 percent for the corn planted May 7, 4.8 percent for the corn planted May 23, and 6.8 percent for the corn planted June 5.

Plots of 45 inbred corns crossed on Tr.X 38-11 were planted on May 7 and June 6 with each series of plots replicated 3 times. First-brood corn borer in the May 7 plantings ranged from 0.1 to 4.4 per stalk in the various plots, while the June 6 planting largely escaped infestation. Dissections of corn plants in the fall in both plantings indicated that the May 7 planting escaped second-brood corn borer while corn planted June 6 averaged 0.4 to 2.4 borers for the various corns. Breakage below the ear, due to corn borer, was worse in the late planting, averaging 10.5 percent compared with 4.7 percent in the May 7 planting.

Costs in silage production

Cost of silage is influenced by kind of crop ensiled and production methods. Costs of corn silage, alfalfa silage, legume-grass silage, and bluegrass silage were found to range from $0.68 per 100 pounds of total digestible nutrients for grass silage without molasses put up with a field harvester, to $1.23 per 100 pounds of total digestible nutrients for alfalfa silage. Assumed yields and cost of silage per 100 pounds total digestible nutrients were as follows:

Kind of Silage	*Assumed Yield per Acre (tons)*	*Costs*[1]	
		Stationary Chopper at Silo	*Field Chopper*
Corn	10	$0.91	$0.74
Alfalfa with molasses	9	1.23	1.17
Without molasses	9	.90	.83
Grass-legume with molasses	4.5	.99	.95
Without molasses	4.5	.72	.68
Bluegrass with molasses	2.25	1.19	1.12
Without molasses	2.25	.96	.88

[1] Calculations were based on labor cost of 50 cents an hour, machinery use and cost as shown in Ky. Expt. Sta. Bul. 484, and cost of concrete stave silo 12 feet in diameter as given in Mo. Expt. Sta. Bul. 303, adjusted to price-level of 1945. Cost data for the field chopper is from unpublished data on machinery costs. No charge was included for land, as the yields are comparable land productivity.

Varieties of winter wheat

Twelve varieties of winter wheat were grown in yield tests on the Pennyrile field. Yields were low, ranging from 9.6 for Missouri Early Premium to 25.5 bushels per acre for Vigo. Low yields were caused by a combination of a severe leaf rust epiphytotic, late spring infestation

of Hessian fly, and prolonged wet weather during harvest which reduced test weights to 51.5 pounds or less. Clarkan, Vigo, and Fulcaster showed least damage from Hessian fly, although none was entirely free from infestation. All varieties were heavily infected with leaf rust early in the season, but Vigo showed somewhat more resistance than any other variety.

Leaf rust was heavy in the yield tests at Lexington, but Hessian fly did not appear. Of the named varieties, Vigo, Red Rock, Nured, and Hardired were the highest yielding but Hardired had the weakest straw of any variety in the test. Several new strains appeared promising in resistance to leaf rust and loose smut, in strength of straw, and in yield. Some of these have the possibility of resistance to Hessian fly and are being tested in southern Kentucky for this character.

Varieties of winter barley

Of 22 varieties grown in yield plots at Lexington, all except one survived the winter with stand of 90 percent or better. Wong survived only 78 percent. No winter-killing occurred in a duplicate test on the Pennyrile field in southern Kentucky.

Ky 1 barley continued to be one of the highest yielding varieties in these tests, being surpassed only by Nassau at Lexington and Davidson and Jackson 1 in southern Kentucky. All these varieties are known to be less winter-hardy than Ky 1 in severe winters.

Two new selections from a composite cross appear particularly promising from 1 year's test, outyielding Ky 1 by 4 and 9 bushels. Both were resistant to mildew, had somewhat stronger straw than Ky 1, and were resistant to loose smut in 1 year's inoculations. Test weights were somewhat less than for Ky 1.

Varieties of fall-sown oats

Seven oat varieties fall-seeded in 1/40-acre plots at the Pennyrile field in Todd county yielded from 60.4 bushels (Fulwin) to 100.8 bushels per acre (Stanton). Victorgrain, Tenn. 090 x Bond, and a selection of Lee-Victoria x Fulwin yielded more than 95 bushels per acre. Winter-killing did not affect stands or yields this year, but from other tests it is known that Stanton and Victorgrain are not as hardy as the other varieties: In nursery trials in Todd county, several other selections of Lee-Victoria x Fulwin and Traveler 1 appear promising. Fulwin, Forkedeer, and Stanton lodged badly, and Fulgrain had the best straw in the plot tests.

In hardiness tests at both locations, Wintok was the only variety which survived the winter 100 percent. Hairy Culberson, Bicknell, and Fulwin survived 90 percent or better, while the more tender varieties such as Fulgrain and Victorgrain survived less than 50 percent.

Varieties of spring oats

The disease caused by *Helminthosporium victoriae,* which has been very destructive to spring oats the past two years, again lowered the yield of susceptible varieties as much as 50 to 75 percent of the yield of resistant strains. It is evident that the disease is becoming more wide-spread and that only resistant varieties should be grown. Seed treatment reduced the seedling infection to some extent, but did not prevent infection in the mature plant stage, and cannot be regarded as an effective control for this disease.

Columbia, the only spring variety recommended for Kentucky, continues to be one of the highest yielding of the commercial varieties. Clinton and Benton, two new varieties grown in the corn belt, have yielded nearly as much, but average nearly a week later in maturity. They have somewhat stronger straw than Columbia. New strains which show promise are Andrew, Mindo, and selections from Columbia x Bond-Iogold, and Columbia x d69-Bond.

Red-clover seed production

On plots at three locations in central Kentucky 42 percent of the florets of the second crop of red clover were either unfertilized or aborted. Forty percent of the florets produced good seed, 8 percent produced shriveled seed, and 8 percent produced seed damaged by insects, almost wholly by chalcid fly. Chalcid fly damage ranged from an average of 8.5 percent of seed destroyed at one location to 29.5 percent of the seed at another.

Yields of good seed were not increased on highly phosphatic Central Bluegrass soil by fertilization with nitrogen, phosphorus, potassium, and boron alone or in combinations. However, on a soil just outside the Bluegrass region somewhat deficient in available phosphorus, an application of 200 pounds of 20-percent superphosphate in the spring increased seed yields 41 percent.

Yields of good seed obtained from the second crop varied with the stage of maturity at which the first crop was cut for hay as, follows: cutting at first bloom, 48 pounds per acre; at 10 days after first bloom, 85 pounds; at 20 days after first bloom, 78 pounds; at 30 days after first bloom, 34 pounds; and at 40 days after first bloom, 9 pounds. Where no crop of hay was cut the first crop produced 11 pounds of seed per acre, and the second cutting produced 0.5 pound per acre.

Threshing the seed from the swath with a combine in central Kentucky recovered approximately half of the seed in the crop on one farm studied, one-fourth of the seed on another farm, and approximately the entire crop on a third farm. Differences in results were due largely to differences in adjusting and operating the combines.

Alfalfa varieties

Two lots of Argentine alfalfa sown in August 1945 produced 5,147 and 5,521 pounds of dry matter per acre from one cutting in late June 1947; Buffalo produced 5,554 pounds; Ranger, 5,740; Hardigan, 5,684; Ky 41, 5,553; Kansas Common, 4,373; and Atlantic 6,647.

Red-clover varieties

Six lots of certified Cumberland red clover from different sources produced 3,001 to 4,125 pounds of dry matter per acre from two cuttings; five lots of certified Ky 215, produced 3,272 to 3,871 pounds; Wisconsin Mildew-resistant, 2,663 pounds; Midland, 2,546; and Kenland, 5,204.

White-clover varieties

Two lots of Ladino clover—one commercial and the other certified—sown in September 1946 produced 4,209 and 4,308 pounds of dry matter per acre from five cuttings; two lots of adapted Kentucky white clover produced 1,241 and 1,308 pounds; and Louisiana-grown white clover produced 953 pounds.

Residual effect of radioactive fertilizer on red clover

No significant differences were obtained in 1947 in yields of Kenland red clover sown in the spring of 1946 in wheat on soil treated at the recommended rates (see Annual Report for 1946, page 24) with radioactive material.

Yield and nitrogen content of vetch and small-grain cover crops

At the time of plowing in the spring of 1947 the cover crops on 9 duplicate plots were sampled, the small grain and vetch were separated, and dry matter and total nitrogen were determined. The seeding rate was 1 bushel per acre for the small grain, and 30 pounds per acre for vetch.

The amounts of nitrogen contained in the small grain ranged from 0.72 percent to 3.68 percent, and varied directly with the amount of available nitrogen produced or contained in the soil during the late fall and early spring. Where small grain and vetch were grown together, a large supply of nitrate nitrogen in the soil during growth of the cover crop produced a high yield of small grain and a lower yield of vetch. On a plot where 100 pounds of nitrogen (in ammonium nitrate) was applied per acre in March, the yield (oven-dry green manure) was 3,901 pounds barley and 1,111 pounds vetch. Assuming that the 100 pounds of nitrogen added in March in test 1 (in the following tabulation) was all taken up by the crop, the barley and vetch combination obtained from the soil and air 65 pounds of nitrogen. Where no nitrogen fertilizer was added (test 2) the barley and vetch obtained from soil and air 140 pounds of nitrogen.

Ability of vetch, when well supplied with phosphate and potash, to fix large quantities of nitrogen was exemplified in test 3. After 40 consecutive crops of tobacco, this soil was so depleted in nitrogen that only 271 pounds dry weight of barley per acre was produced, containing 5 pounds of nitrogen. The vetch, however, produced 3,150 pounds of dry matter per acre, containing 127 pounds of nitrogen. Oven-dry matter and nitrogen content of green manure in the several tests were as follows:

Test No.[a]	*Fertilization per Acre Prior to Sampling, 1947*	*Crop*	*Dry Matter*	*Nitrogen in Green Manure* Percent	Pounds per Acre
1	100 lb nitrogen in March[b]	Barley	3901	2.97	116
		Vetch	1111	4.41	49
		Total	5012	...	165
2	None	Barley	1392	2.01	28
		Vetch	2615	4.28	112
		Total	4007	...	140
3	None	Barley	271	1.61	4
		Vetch	3150	4.02	127
		Total	3421	...	131
4	None	Barley	1751	1.48	26
5	100 lb nitrogen in March[b]	Barley	4850	2.54	123

[a] Tests 1, 2, 4, and 5 are on land now in continuous tobacco production on the Experiment Station farm, Lexington, and are in duplicate. Test 3 area has been in continuous tobacco cultivation for 40 years, the 40th crop of tobacco being the 1946 crop.

[b] Nitrogen applied as ammonium nitrate.

Effect of sod management on seed production of orchard grass and Ky 31 fescue

Four ways of management on 1/138-acre plots of 2-year-old sod of orchard grass and of Ky 31 fescue were (1) no clipping or other treatment except a single removal of herbage at the time of seed harvest; (2) continuous clipping after seed harvest; (3) early spring or late winter burning; and (4) early spring or late winter burning plus top-dressing of ammonium nitrate at the rate of 100 pounds per acre, in the spring. Pounds of clean seed per acre and test weights of the clean seed obtained from the treatments were as follows:

	Orchard Grass	*Ky 31 Fescue*	*Orchard Grass*	*Ky 31 Fescue*
Unclipped	436	428	14.7	19.3
Clipped	468	302	15.1	19.7
Spring burning	478	440	14.6	18.8
Spring burning plus N	659	636	14.1	18.2

In another test a 10-year sod of Ky 31 fescue that had produced very low seed yields in 1945 and 1946 was treated variously and harvested for seed in 1947. One treatment was a thorough rototilling of the sod to a depth of 6 inches in the fall of 1946. Other plots were left untreated following seed harvest in 1946. Other plots were clipped frequently in 1946 following seed harvest. Portions of all plots were

fertilized in the fall and spring with ammonium nitrate at the rate of 100 pounds per acre.

Pounds of clean seed obtained were as follows:

Treatment	*No nitrogen added*	*Ammonium nitrate, 200 lb*
Unclipped	83	181
Clipped	98	293
Rototilled	141	280

Rototilling the sod was followed by growth of weeds which made it difficult to produce high-quality seed.

Orchard grass strains

Ten strains of orchard grass were compared in a performance test at Lexington, on 1/436-acre plots replicated six times. Nine of the strains were from farms where the seed had been saved and replanted from 15 to at least 25 years. The tenth strain was a synthetic production originating from a combination of seven superior individual plants. Yields of dry matter per acre ranged from 4,632 to 4,090 pounds, the synthetic strain producing the highest yield. In addition to its superior yielding qualities, the synthetic strain was leafier, greener, and somewhat more disease-resistant than any of the old strains.

Grass breeding and improvement

Twenty isolated crossing blocks were established in 1947 for the production of new synthetic strains of tall fescue, orchard grass, smooth bromegrass, and Kentucky bluegrass, The superior plants selected for these isolated blocks came from a nursery of more than ten thousand individual spaced plants. It is expected that seed will be harvested from these new combinations in 1948 and used in performance tests in 1949.

Time of applying nitrogen fertilizer in relation to seed production of orchard grass and Ky 31 fescue

Two-year-old orchard grass and Ky 31 fescue sods were fertilized at the rate of 100 pounds of ammonium nitrate per acre, some in October, some in January, some in February, and others in April. They were given no other special treatment. Acre yields of clean fescue seed were, respectively, 673, 635, 608, and 607 pounds, and of orchard grass seed, 633, 562, 564, and 539 pounds. Unfertilized companion plots in both tests, containing small amounts of alfalfa, produced 660 pounds of Ky 31 fescue seed and 593 pounds of orchard grass seed. Seed from the unfertilized plots was slightly higher in quality, as measured by weight per bushel.

Effect of method and rate of seeding on seed production of orchard grass and Ky 31 fescue

Broadcast seedings at the rates of 3, 7, and 15 pounds of seed per acre were compared with seeding in rows spaced 27 inches apart.

Pounds of clean seed per acre and test weights of the clean seed obtained were as follows:

Seeding	*Orchard Grass*	*Ky 31 Fescue*	*Test weight, lb per bu* Orchard Grass	*Ky 31 Fescue*
Broadcast				
3 lb per acre	543	768	15.0	18.8
7 lb per acre	447	592	14.8	19.1
15 lb per acre	368	494	15.3	19.2
Rows 27 inches apart	744	855	15.6	19.2

In another test Ky 31 fescue in rows, either 15 or 30 inches apart produced 50 to 100 percent more seed than broadcast seedings at the rate of either 8 or 20 pounds per acre. Rows 15 inches apart yielded the same amount of seed as those 30 inches apart.

Fescue strains

Seven naturalized strains of tall fescue from Kentucky, two synthetic strains, and Alta fescue were compared in a performance test at Lexington on 1/436-acre plots. Herbage yields, obtained from 3 clippings, ranged from 4,744 to 3,808 pounds of dry matter per acre. The highest yield was produced by Ky 43, one of the naturalized strains. The superiority of this strain was apparent throughout the season with respect to recovery after clipping, retention of green color, and resistance to leaf diseases. Ky 42, as in previous years, also produced significantly more herbage than Ky 31. There was no significant difference in the yields of Alta and Ky 31 fescue. All strains except one were resistant to leaf rust.

Effect of placement of fertilizer on pasture yields

Experiment fields were established near Mayfield, Greenville, and Bowling Green, in the spring of 1947, for comparing surface and subsurface placement of various fertilizers and ground limestone on dry-matter yields of permanent pastures on three major soil types. Herbage was harvested by clipping protected areas when the herbage had attained a height of 4 inches.

Yields obtained at Mayfield and Greenville from top-dressing with 200 pounds of P_2O_5 per acre in rock phosphate were 1,654 and 2,501 pounds, respectively, of dry matter per acre. Where the same amount of this fertilizer was applied 4 inches deep in rows 1 foot apart, on each field, the dry-matter yields were 1,288 and 1,948 pounds per acre, respectively. Where 100 pounds of P_2O_5 in triple superphosphate was top-dressed per acre, yields were 1,735 and 3,760 pounds dry matter per acre on the two fields, as compared with 1,539 and 2,848 pounds per acre, respectively, from subsurface treatment. The same amounts of P_2O_5 in meta and fused phosphate applied to the surface were likewise more effective in herbage production than subsurface treatments. Where limestone was used as a top-dressing at Greenville the yield was

373 pounds greater than where applied 4 inches under the surface, but the difference at Mayfield was only slight.

The Bowling Green experiment field was established to compare surface and subsurface placement of triple superphosphate at depths of 2, 4, and 6 inches. Field observation and dry-matter yields showed no significant difference the first year.

Plant bugs *Miris dolobratus* and *Amblytylus nasutus*

Miris dolobratus in general was not numerous enough in 1947 to do noticeable damage to Kentucky bluegrass. The largest number taken in a single sweep of an insect net was 38, but the average number for a single sweep was 2.7. *M. dolobratus* was more numerous on plots of bluegrass that had received nitrate in the spring than on check plots or untreated plots in 7 series of plots, but the differences were not significant. There was an average of 1.6 times as many bugs on fields that had not been grazed in fall and spring as on grazed fields.

Amblytylus nasutus was present on several farms in numbers large enough to damage seed heads, but the number differed greatly at different places on the same farm and on different farms. Nine collections from 6 farms gave an average of 29.4 bugs to a sweep of an insect net, the range being 0.68 to 73.6 per sweep. More *A. nasutus* bugs were found on bluegrass plots treated with nitrate in the spring than on untreated plots. Collections were made from treated and untreated plots in 7 series of plots. There was an average of 2.1 times as many bugs in fields that had not been grazed in the fall and spring as on grazed fields.

Control of green June beetle larvae

Tests were made in the spring of 1947 for control of green June beetle larvae by applying benzene haxachloride and chlordane on the surface of the soil in cages containing the grubs. Benzene hexachloride was applied at rates of ½ and 1 pound of the gamma isomer, and chlordane at rates of 1 and 2 pounds per acre, the chemicals being stirred into the soil to a depth of 2 to 3 inches. Cages were 24″ x 24″ x 24″, made of frames covered with screening, and placed to a depth of 15 inches in the soil. Each cage contained 40 grubs. There were five replications of each treatment and five untreated cages. Control was not satisfactory in any treatment, averaging 48.8 percent for ½ pound of gamma isomer, 48.2 percent for 1 pound of gamma isomer, 28.1 percent for 1 pound chlordane, and 26 percent for 2 pounds chlordane.

Control of white grubs in sod

Three new soil insecticides were tested early in May in a series of replicated bluegrass sod plots, for control of second stage *Phyllophaga* grubs. Counts made 7 weeks later and compared with untreated

check plots indicated that chlordane emulsion, at the rate of 5 pounds of actual chlordane per acre, gave an average mortality of 80.3 percent; benzene hexachloride emulsion, at the rate of 2 pounds of the gamma isomer per acre, gave an average mortality of 78.9 percent; and a one-half saturated solution of DD (1.3 dichlorpropene – 1.2 dichlorpropane) applied at the rate of 1 quart per square foot gave a mortality of 26.9 percent. Similar tests with the first two materials were made in late July using third stage *Phyllophaga* grubs. Counts made two months later indicated that the benzene hexachloride emulsion gave an average mortality of 55.8 percent while the chlordane emulsion gave an average mortality of 37.6 percent. None of the materials injured the bluegrass in either test.

May beetle control

Three series of spray tests were made during May and June to compare the effectiveness of acid lead arsenate, DDT, chlordane, and benzene hexachloride for control of May beetles (*Phyllophaga hirticula* Knoch) feeding on pin oak foliage. In every test chlordane used at the rate of 1 pound of actual material in 100 gallons of mixture gave excellent control of both males (90, 94, and 95 percent kill) and females (90, 92, and 84 percent kill). However, chlordane showed little if any repellance, much of the foliage being consumed. Results with the other materials were rather erratic. DDT and lead arsenate were very repellent to the beetles and very little of the treated foliage was eaten. Benzene hexachloride at the rate of ¼ pound of the gamma isomer in 100 gallons of mixture was moderately repellent but gave good control in only one test out of three.

Taxonomy of white grubs

A study was made of larvae of the scarab subfamily Geotrupinae and ways were found for distinguishing the larvae of *Geotrupes blackburni* (Fab.) *G. ulkei* Blanch., *Typhoeus typhoeus* L., *Lethrus apterus* Laxm., *Eucanthus lazarus* (Fab.), *Bolbocerosoma tumefactum* (Beauv.), *Odontaeus simi* Wallis, and *Pleocoma hirticollis vandykei* Linsley.

Life history and control of wireworms

Wireworms (*Conoderus lividus*), from eggs laid June 30 to August 13, 1945, completed their growth in 1 or 2 years. The 1-year brood matured during the summer of 1946 and the 2-year brood during the summer of 1947. Larvae in 1947 pupated May 31 to July 5, and adults appeared June 24 to July 17. The average cycle from egg-laying to the adult stage was 1 year and 357.7 days, and the range was 1 year and 332 days to 2 years and 20 days.

Preliminary tests for controlling wireworms that injure tobacco plants were made with benzene hexachloride and chlordane in the

spring of 1947. The benzene hexachloride was used at rates of ½ and 1 pound of the gamma isomer per acre and the chlordane at 1 and 2 pounds per acre. These chemicals were broadcast on the land and stirred into the soil 3 weeks before the tobacco plants were set. There were 3 replications of the treatments and 3 untreated plots. An average of 18.7 percent of plants were injured by wireworms in the untreated plots. Where benzene hexachloride, ½ pound of gamma isomer, was used, an average of 7.7 percent of plants were injured, and 5.6 percent injured where 1 pound of the gamma isomer was used. An average of 8.3 percent of plants were injured in plots where 1 pound of chlordane was applied and 8 percent where 2 pounds was applied

Orchard spray service

Information was disseminated by this service through 17,106 spray letters sent to 2,675 Kentucky fruit growers and to county agents.

Apple scab

In tests for control of apple scab, Puratized Agricultural Spray was tried in three test plots. One plot was with a grower near Mayfield, one with a grower near Owensboro, and the third was at the Substation at Princeton. Control was entirely satisfactory in the plots at Princeton and Owensboro, but at Mayfield the new material did not control scab as satisfactorily as liquid lime sulfur. Cedar apple rust and quince rust were somewhat serious in the Princeton plot sprayed with the Puratized Agricultural Spray.

Apple varieties

Injury to apples at Lexington from late frosts and unfavorable weather for pollination was unusually great in 1947. Early blooming varieties, especially Delicious, were most seriously damaged. For addition to promising new varieties that have been described in earlier reports, the following varieties should be mentioned:

USDA 50: Very similar to "Close," ripening at about the same time, and having about the same appearance and qualities. Harvesting time, June 19-25.

USDA 49: Fruits somewhat smaller than those of Close and USDA 50, and not quite so red, but production per tree has been heavier. Cooking qualities excellent. Harvesting time, July 1-6.

Milton: Fruits resemble McIntosh in several respects but ripen nearly a month earlier: pinkish-red, with a pronounced bloom and aroma. The flesh is white, crisp, juicy, and excellent in quality. Harvesting time, July 25-30.

Melba: Three trees of this variety, set in 1944 and 1945, are now growing in the Experiment Station orchard. The variety is a rela-

tively new McIntosh seedling which was developed in Canada. This year the oldest tree produced 15 apples and the other two, 10 apples each. The quality and attractiveness of these apples were outstanding. Fruits are attractive crimson, waxy and aromatic, above medium size to large; flesh very fine textured, white, and delicious. The fruits bruise easily and for that reason would not ship well, but the variety should be a splendid kind for home use or roadside sales. The fruits were picked on July 2 and 3.

Webster: A tree set in the Experiment Station orchard on April 6, 1940, produced 1 bushel of fruit in 1946 and 9½ pecks this season. The fruits are attractive deep red, large, and exceptionally uniform. Especially good for cooking, ripening when there are few good cooking apples available. Harvesting date, August 14 in 1946, and September 16 this season.

Conard: Trees from the Missouri Fruit Testing Association were set March 29, 1937. They bore a few fruits in 1944 and one tree bore 1 bushel in 1946 and 3½ pecks this season. The fruits are attractive deep red and well formed, moderately acid, and good in quality. Harvesting time, September 20-25.

Peach varieties

Practically all varieties in the Experiment Station planting bore a good crop. Outstanding among the yellow freestone varieties were Halehaven, Goldeneast, Sunhigh, and Summercrest. Amber Gem was outstanding as a yellow cling-stone variety. Varieties which have not been satisfactory after several years' trial are Candoka, Hardee, and Polly.

Insect injury to peaches

A survey of damage to the 1947 peach crop was made during Elberta harvest in western Kentucky orchards. Curculio control was unusually good this year in spite of the heavy carry over of adults. No curculio-injured fruits were found in 6 of the 12 orchards surveyed. The heaviest damage found in any one orchard was 18 percent. Damage from oriental fruit moth was on the increase with 2 of the 12 orchards having 23 percent and 25 percent of their fruit injured. In general, where DDT was used late in the season, oriental fruit moth damage was much reduced. Catfacing of peaches was serious in several orchards, occurring at the rate of 2 to 24 percent of the fruit examined.

A study was made in 4 western Kentucky peach orchards of the comparative effectiveness of spray and dust schedules designed to give maximum control of curculio with minimum foliage injury. In general, slightly better control (2 percent injury) was obtained with a benzene hexachloride schedule (acid lead arsenate spray used

for second-brood control) and with a straight acid lead arsenate spray schedule (2.5 percent injury). Basic lead arsenate dust and acid lead arsenate dust schedules gave 4.3 percent and 5.6 percent injury respectively. None of the materials used caused any appreciable injury to foliage.

In one orchard, two treatments of several materials, applied July 18 and July 30, were compared as a control measure for second-brood curculio in an area where curculio damage was very severe in 1946. Where chlordane was used at the rate of 4 pounds of actual chlordane per 100 gallons of mixture, there was 2.4 percent injury by curculio; where half that much chlordane was used there was 5.4 percent injury. Curculio injury with acid lead arsenate dust was 2.6 percent and with acid lead arsenate spray, 6.3 percent.

Peach pruning

Results in the peach pruning test at Henderson were as follows in bushels of fruit per tree (10-year-old trees): no pruning, 13.3; modified leader, 9.7; converted from modified to open center, 9.1; and open center, 7.8 bushels. Fruit from the non-pruned trees was smallest (241 per bushel), that from the modified-leader trees was next in size, and that from the open-center trees was largest, (173 per bushel). The heavy over-load of fruit on the nonpruned trees caused a severe limb breakage and a spreadage that interfered with orchard passage.

Grape varieties

Among nine varieties of grapes planted in 1945, Portland was outstanding among the newer varieties under test. The fruits are light green, very good in quality, with well-formed clusters, and the vine possesses good vigor. The yield (29.3 pounds per vine) was exceptionally high.

Both Fredonia and Sheridan appear promising, Fredonia displaying the greater vigor. The clusters of both kinds were well formed and the quality good. Fredonia precedes and Sheridan follows, Concord in ripening time. Fredonia averaged 17.2 pounds per vine and Sheridan 28.0.

Golden Muscat seemed only fairly vigorous, but yielded 19.3 pounds per vine. Fruits were large but their color, quality, and flavor were not all that could be desired.

Urbana vines were weak, they set only a small quantity of late-ripening, tough-skinned, pink fruit only fair in quality.

Concord Seedless formed a large number of clusters, but they ripened so poorly and unevenly that no measurable quantity of fruit could be harvested from them.

Concord averaged 19.7 pounds per vine and Niagara 14.2 pounds.

Black raspberry yields

A planting of Quillen black raspberries at the Experiment Station farm, in its second bearing season, yielded at the rate of 367 crates (24 pints each) per acre, and Morrison yielded at the rate of 354 crates per acre.

Harvesting dates for the two kinds were about the same.

Quality also was similar, the fruits of Morrison being softer, slightly darker, somewhat better developed, and not quite so acid as those of Quillen. Some anthracnose has occurred in the planting, but has been held in check fairly well by one dormant and three summer sprays. Quillen seems less susceptible to anthracnose than Morrison.

Strawberry varieties

In trials over a 4-year period of Blakemore, Tennessee Beauty, Tennessee Supreme, Tennessee Shipper, Premier, Fairfax, and Catskill, Tennessee Beauty has proven to be an outstanding producer, with attractive fruit of high quality. Ripening time this year ranged from May 29 to June 23, while in 1946 the same varieties were harvested between May 7 and June 10. This year Tennessee Beauty produced the highest yield (231 24-quart crates per acre), and Blakemore the lowest (133.5 crates).

Red stele disease of strawberries

On the Station farm at Lexington a planting of strawberries in which red stele developed seriously in 1947 was divided into plots and various cultivation and fertilizer treatments were tried to determine their effect upon the development of the disease. On two of these plots the plants recovered remarkably during the season, after harvest. The treatments on these two plots were as follows. On one the plants were mowed after harvest; the mulch burned; ammonium nitrate was applied at the rate of 400 pounds per acre, superphosphate 500 pounds per acre and boron 20 pounds per acre; the rows were narrowed to 12 inches and fertilizer worked into soil with an Ariens tiller. On the other plot the plants were mowed; mulch was left between rows; ammonium nitrate was applied at the rate of 400 pounds per acre; rows were narrowed to 12 inches with an Ariens tiller. On both plots, from mid-July until the end of the season, the area between each row was cultivated five times with a tiller which was run to a depth of about 6 inches and the soil was very effectively pulverized to that depth. All weeds in the rows were removed by hand.

Strawberry renovation

During the 1947 harvest season records were obtained on the yield of Blakemore strawberries worked out by different methods after their first harvest year in 1946, on the farm of a cooperator near

Paducah. The treatments and yields per acre were (1) plants mowed off just after harvest and middles scratch-cultivated until fall, 190 crates; (2) plants not mowed and middles scratch-cultivated until fall, 197 crates; (3) rows barred off to one foot width and middles cultivated until fall, 178 crates; (4) weeds mowed above strawberry foliage, no cultivation, 82 crates. Berry size was decidedly off in the plots that received no cultivation. In the cultivated plots berry size was about the same, with a slight advantage in favor of the barred-off rows. This is the third year that scratch-cultivating of the middles after harvest, with or without mowing, has produced higher yields than barring off.

Split applications of nitrogen and potash fertilizers for potatoes (spring crop)

Previous work had shown that split applications of nitrogen caused greater increases in yield of potatoes than when all was applied at the start, and also that a sufficiency of potash helped make late nitrogen applications more effective. For this reason late applications of potash were tried in 1947. With potassium, late applications on all plots caused increases over applying all at the start. The highest increases were with the smallest application, but increases from all amounts except with one application of 400 pounds, were substantial.

Fertilizer timing test on potatoes in greenhouse

Potatoes were grown in 6-hill plots in the greenhouse and nitrogen and potassium were varied by additions to a soil known to be low in these elements. Nitrogen was added in various amounts at the start and just after bloom, and potassium was added in various amounts at the start. Content of these fertilizer elements in the plant at various stages of growth, as determined by tests of tissue of the lower mature petioles, was correlated with eventual yield. Yields were highest where nitrogen in the plant tissues was up to about 1,000 ppm in the early stages of growth and up to at least 1,500 ppm in the post-bloom stages. Only moderate amounts of nitrogen should therefore be applied to potatoes at planting time, and larger amounts should be added after bloom. Yields also were higher generally where potassium content of the lower mature petioles was about 5,000 ppm than where it was only 3,000 ppm.

Tomato varieties

In replicated trials of 16 tomato varieties (4 x 4 balanced lattice), Garden State ranked highest when total yield, early yield, July size, total size, and percent salable were considered. It ranked next to highest in total yield, highest in July size of fruit, third in July percent salable, and fourth in total size.

In early yields, Valiant was first, Pritchard second, and Globe third.

Pearson S had highest total yield, but was late and ranked low in total percent salable. No. 164 and No. 409 also ranked high when all points were considered. No. 18 was quite early and total percent salable and was second only to Pritchard. Rutgers was high only in total size. Pritchard was outstanding in quality and highest in percent salable. The varieties for cooperative testing in this and other states were supplied by the Vegetable Breeding Laboratory, Charleston, South Carolina.

Fertilizing tomatoes

In earlier tests the splitting of fertilizer applications, applying part at the start and part later in the growing period had resulted in better yields of tomatoes than where all the fertilizer was applied at the start. Also, in 1946 the additions of small amounts of radioactive material to the fertilizer seemed to have some stimulating effects on tomatoes. In order to test these matters further they were tried this year in a 5 x 5 Latin square experiment. Application of all the fertilizer at the start proved to be the best this year, apparently because more nitrogen than usual was leached out in the cold, wet spring, and therefore more nitrogen was needed early. Also under the seasonal conditions existing in 1947, radioactive compounds seemed to depress the yield of tomatoes.

Sprays for the control of tomato blight

In a comparison of (1) Cuprocide (yellow copper oxide), 1½ pounds per 100 gallons of water, (2) Fermate and Zerlate applied alternately, 2 pounds per 100 gallons, and (3) Syndeet, 1 pound per 100 gallons, for control of blight on the main-season tomato crop at the Experiment Station, Cuprocide proved most effective in reducing the number of blighted tomatoes, increasing average size of fruit, and increasing the yield over that of check plots not sprayed. The sprayed plots were sprayed four times – first shortly after setting, and at intervals of about 10 days thereafter, until the crop was about made. First sprayings were with a hand sprayer; the others with a power sprayer.

For spraying the late crop, Cuprocide, Parzate, and Copper A were compared. While Cuprocide again was effective, it was not so effective as Copper A. Where Copper A was used the yield was 1.26 tons per acre greater than where Cuprocide was used, and the fruits averaged larger. Parzate gave good control of blight, but the yield was low. In view of a difference of nearly two tons per acre between check plots, the yield differences between treatments probably were not highly significant.

Fall versus spring plowing for early tomatoes

The average yields of 4 replicated plots of Valiant tomatoes, fall plowed, was 7.66 tons of early tomatoes per acre, and the average for 4 plots plowed in the spring was 5.96 tons per acre.

Rototilling versus the moldboard plow for early tomatoes

Four plots of Valiant tomatoes were rototilled at the start and all the cultivation was done with the rototiller. Four other plots were plowed with a moldboard plow and cultivated with an ordinary 5-tooth cultivator. The rototilled plots gave an average yield of 7.11 tons per acre and the plowed plots 6.46 tons per acre — a difference of 26 bushels per acre. Where the rototiller was used weed control was better and there was less washing and run-off. Also, fewer cultivations were needed to control weeds by the rototiller than by the plow.

Marketing green-wrapped tomatoes

To determine the suitability of various containers for green-wrapped tomatoes, four experimental truckloads of tomatoes consisting of 1,907 packages with 74,180 pounds of tomatoes, were shipped to Chicago. Eight different types of containers were used: Spartan Boxes, sweetpotato crates, shed crates, three-hoop tub-type bent-bottom bushel baskets, board-bottom tub-type bushel baskets, one-half bushel baskets, 10-pound cardboard baskets, and the standard lug.

Taking such factors into consideration as cost of container, reuse and resale value, adaptability, type of pack and its cost, and type of transportation to be used, in the final selection of a container the bent-bottom three-hoop, tub-type bushel basket fulfilled the requirements better than any of the other containers used. By using the bushel basket with a jumble pack and shipping by truck, local costs of handling were reduced almost 50 percent and at the same time the quality of the tomatoes was maintained with no greater in-transit damage than when the more costly lug was used.

There was no apparent difference in the quality of or in-transit damage to tomatoes packed in any of the three methods used. For that reason, the cheapest pack, the jumble pack, was used in the third and fourth loads for all containers except the standard lug.

The only container damage noticeable was in the lugs, where the top end row of tomatoes was damaged in lidding. The greatest percentage loss was due to shriveling of immature tomatoes, while rough, careless handling also accounted for an important percentage of the loss. Two-thirds of the final loss could have been prevented with greater care by the farmer during picking and transporting the tomatoes to market and more careful handling during packing.

Snap-bean varieties

In both the early and late plantings, Logan produced the most bushels per acre (413 bushels early and 404 bushels late). Yellow Cherokee was next (377 bushels early and 352 bushels late); Stringless Greenpod No. 100 was third (374 bushels early and 352 bushels

late); B-1636 was fourth, and Florida Belle, 5th. Logan was not quite so long nor so deep in color as Stringless Greenpod No. 100, but it was of very good quality.

Sweet-corn varieties

Two plantings of 43 varieties of hybrids were made, one on May 6 and the other on July 28. When total yields, size of ear, percent early yields and percent worm-free, under both early and late crops are considered, Seneca Giant ranked first; Trucker's Hybrid, second; Stowell's Hybrid, third; and Aristogold Bantam Evergreen and KVF-45 tied for fourth. Tri-State and Golden Grain also ranked high. KVF-45 had even larger ears than Seneca Giant. Trucker's Hybrid and Evergreen Hybrid also have large ears, an important item for the Kentucky market.

In resistance to earworm damage Evergreen Hybrid or Iogreen-56 was best, KVF-45 and Purdue R-5 were second, and Hybrid Stowell's was third. The late crop had 100-percent infestation on all varieties.

Control of European corn borer in sweet corn

Field tests were made of a 5-percent DDT dust and a ryanfa dust containing 40 percent ground ryania stems, applied to early sweet corn. Four treatments of each material were made at 5- to 7-day intervals on Spancross sweet corn planted April 23 and similar treatments were made on Bantam Evergreen planted May 6. Treatment was begun June 13 when the first corn borer eggs were beginning to hatch. At this time the sweet corn averaged 30 inches in height.

Harvest counts on both varieties indicated that both ryania and DDT were very effective in reducing the corn borer population, the ryania giving somewhat better control than DDT. In the Spancross plots the borer population in untreated plants averaged 11.5 corn borers per plant, compared with 1.63 borers in plants treated with DDT and no borers in plants treated with ryania. In the Bantam Evergreen plots the borer population in untreated plants averaged 2.0 corn borers per plant compared with 0.1 corn borers in plants treated with DDT and no borers in plants treated with ryania. Plants in untreated plots were noticeably shorter than those in treated plots and in the untreated Spancross plots most of the ears were unusable because of direct corn borer injury. Neither of the treatments was effective in controlling corn earworm.

Cucumber varieties

Of 11 varieties tested for total yield, earliness, and percent pickles, Marketer (Burgess), straight Eight, and Packer PC4311 ranked highest, in the order listed. Considering the three qualities separately, Marketer (Burgess) was highest in total yield, followed by Packer PC4311, Imp. Long Green, Early Michigan, and Straight Eight. In

earliness, Model M-4568 was first, followed by Packer PC4311, Producer M4566, Straight Eight, and Marketer (Burgess). In percent pickles, Marketer (Burgess) was first, followed by Marketer M4564, Chinalong, and Straight Eight, — Packer PC4311 being 10th.

Public Service Laboratories

A total of 30,433 samples of foods, drugs, and public health specimens were examined in this department during the year. Microscopical examinations for rabies were made on 296 animal heads, of which 107 or 35.1 percent were positive. A total of 2,532 specimens of feces and urine, submitted by County Health Departments, chiefly from food handlers, were examined for typhoid, para-typhoid, and other enteric diseases. Of these, 17 specimens were positive for E. typhosa, of which 7 were from food handlers, 5 from convalescent cases, three from incipient cases, 1 from a known carrier, and 1 unclassified. Organisms of the Salmonella group were isolated from 4 specimens.

A total of 1,444 cultures and microscopical examinations were made on 2,229 throat cultures for the presence of organisms resembling Corynebacterium diphtheriae and beta hemolytic streptococci. Of this number 99 were positive for C. diphtheriae and 389 showed the presence of beta hemolytic streptococci.

Animal inoculations for virulence were made from 14 specimens, each of which showed the cultures to be a virulent strain of C. diphtheriae.

Microscopical examinations of stained smears prepared from specimens of sputum, concentrated by flocculation method, were made on 1,185 specimens, with 209 positive for tubercle bacilli. Cultures on special media for tubercle bacilli were made on 375 microscopically negative specimens of sputum, and 11 were found to be positive.

Examinations for intestinal parasites and ova were made on 1,403 specimens of feces. Of these, 253 were positive for Ascaris lumbricoides, 43 for Necator americanus (hookworm), 9 for Taenia nana, 66 for Trichuris trichiura, 2 for Oxyuris, and 1 positive for Strongyloides.

Of 7,192 specimens examined for Gonorrhea, 2,340 or 32.5 percent were reported as positive or suspicious. Examinations were made of 225 smears from eyes of new-born babies for Gonorrheal Ophthalmia, and 92 were reported positive.

Serum agglutination tests were made on 204 blood specimens. Twenty-two were positive for Brucellosis, 13 were positive for Pasteurella Tularensis, none were positive for Rocky Mountain Fever.

Bacteriological examinations were made on 4,787 samples of water from wells, cisterns, springs, reservoirs, and city supplies. With the

exception of chlorinated city water supplies, the percentage of polluted waters continued high.

Chemical examinations were made on some 136 water supplies, for chemical composition, hardness, or some important constituent such as iron, salt, or hydrogen sulfide, which might make the water objectionable when used for domestic purposes. Chemical analyses were made on 14 samples of water from wells submitted by U. S. Geological Survey, 6 samples from the water supply at Cumberland Falls Park, Kentucky Lake State Park and from Carter Caves for the Division of State Parks, and 16 samples from County Health Departments for analyses for treatment and for use as public water supply. Examinations were made on 15 samples of stream water for evidence of pollution by distillery waste, cattle feeding pens, sewage effluent, or mine drainage.

Bacteriological examinations for sanitary quality were made on 3,578 samples of milk, cream, and other dairy products. Of these, 77 samples were found to contain added water (maximum 51 percent), 77 were low in butterfat, and 159 showed the presence of a preservative — hypochlorite.

The Phosphatase Test for pasteurization was made on 795 samples of pasteurized milk, cream, buttermilk, chocolate milk, ice cream, and granular curd cheese, and results showed 22 milks, 2 creams, and 6 samples of granular curd cheese were under-pasteurized.

The drug chemist made examinations of a wide variety of products for evidence of poison submitted in connection with 44 cases of suspected poisoning, 10 toxicological examinations on humans, and 33 cases of animal poisoning.

A total of 26 samples of disinfectants were submitted for evaluation as to their germicidal efficiency for use in the sterilization of dairy and restaurant equipment. Of these samples, 21 were found to be germicidal within 5 minutes under the conditions of the test.

Forty-one special investigations were conducted during the year. Most of the samples were connected with cases of suspected food poisoning, some were for sterility tests, while others were for the identification of foreign material found in food or drinks.

Nursery inspection

During the year the nursery inspector made 88 regular inspections, including 58 inspections of general nursery stock, 5 of fruit trees, 7 of strawberry plants, 12 of bulbs and perennials, 3 of sweetpotato beds, and 3 of greenhouses. On the premises inspected the following insects and diseases, listed in order of frequency of appearance, were found. Insects: bagworm, oriental fruit moth, strawberry crown borer, gladiolus thrip, blister beetle, iris borer, pine shoot moth. Red spider ranked second among pests found. Diseases: cedar rust, iris leafspot,

peony blight, gladiolus scab, phloem necrosis, damping off (pine seedlings).

Seed inspection

During the year 8,351 samples of seed were tested, of which 596 were official samples taken by inspectors in the field. The remaining samples, sent to the laboratory by seedsmen, farmers, and others, included 2,685 of grass seed, 2,589 of legume seed, 1,419 of cereals, 665 of tobacco seed, 312 of vegetable seed, 64 of hemp seed, 7 of cotton seed, and 14 samples of miscellaneous seeds. Tobacco seed cleaned during the year amounted to 3,361 pounds. There was a noted increase in the number of fescue samples submitted for test this year.

Feed control

The Feed Laboratory analyzed 2,009 samples, of which 1,716 were brought in by the inspectors and 293 were sent in by manufacturers, dealers, or consumers. Of these 293, 40 were checked for poison, 41 were for microscopic analysis only, and the remainder were for complete chemical analysis. License tags were issued for 609,600 tons of feedstuffs.

Colaborative work was carried on with the National Research Council and with feed control officials in other states. Check feed control samples for the Association of American Feed Control Officials were analyzed at frequent intervals.

Four suits filed for prosecution because of adulteration and misbranding resulted in fines and court costs. One case of serious adulteration was reported to the Federal Food and Drug Administration, as it was an interstate shipment. This case is pending.

Fertilizer control

During the year 1,260 official samples were taken by our inspectors, analyzed, and reported. In addition, 47 samples from farmers, county agents, and others were analyzed. Analysis of a monthly check sample sent to about 75 cooperating chemists was continued. An investigation on sampling fertilizers was begun and the results were reported to the Association of Official Agricultural Chemists. Collaborative work was carried on with chemists of the Association on certain phases of the determination of nitrogen and of phosphoric acid in fertilizers. License tags were issued for 465,500 tons of fertilizer, the largest total for Kentucky on record.

Two cases were filed for prosecution because of failure of products to equal guaranty, resulting in fines and court costs. Two shipments of fertilizer were found to be seriously under weight. Purchasers were fully reimbursed by the company as a result.

Analyses of limestone, marl, soil, and miscellaneous materials

During the year 397 samples of limestone from 100 counties were analyzed for neutralizing value. Analyses also were made of 59 samples of marl from 33 counties, 15 samples of slag from 9 counties; 33 samples of soil from 8 counties; 12 samples of water from 5 counties; and about 101 miscellaneous samples.

WESTERN KENTUCKY SUBSTATION

General farm production

Despite increased difficulties in getting and keeping sufficient labor and in getting needed supplies and equipment, farm production was very good this year. An abundant supply of hay was harvested and stored. Both silos were filled with good corn silage. Corn and tobacco yields were satisfactory, though considerably reduced by the drouth of late July and August. A good wheat crop was harvested; the straw was baled for bedding and enough of the grain was kept for use in the poultry rations for another year. All cattle on the farm had the advantage of good pastures, though all pastures became very dry for several weeks in late summer. Approximately 2,000 bushels of peaches and 1,000 bushels of apples were harvested and sold. Thirty-four steers, used in pasture experiment this year, were sold at the end of grazing season and 32 good Hereford steer calves were purchased in mid-October for use in 1948 grazing tests.

Poultry flocks

The poultry flocks consisted of approximately 600 laying hens and 1,200 young chickens. These were divided into three pens each of Barred Rock and New Hampshire hens and two broods each of Barred Rock and New Hampshire chicks.

Dairy herd

The dairy herd averaged 16 cows, about 20 heifers and calves, and 1 herd bull. All requirements for production of grade A milk were fully met. Production from December 1, 1946 to December 1, 1947, averaged 7,141 pounds of milk and 385 pounds of butterfat per cow. Income above feed cost per cow averaged $295.68, not including income from sale of 4 cows and 6 calves. Eighteen calves were born during the year. In the management and feeding of the dairy herd, maximum use of pasture, hay, and silage are emphasized to conserve grain and to reduce cost of feeds.

Pasture experiment

In this experiment, on poor sandstone soil more or less typical of the Western Coal Field area of Kentucky, yearling Hereford steers

gained as follows in weight in 1947 and in the 19 years of consecutive grazing:

Treatment (Total per acre during the experiment)	*Pounds of Gain per 10-Acre Field*	
	1947	*19-Year Average*
None	530	480
3407 lb rock phosphate	1515	1619
1863 lb 20% superphosphate and 2½ tons limestone	1505	1621

Gains in 1947 were substantially below average for the experiment. Rainfall during June, July, and August was but 54 percent of normal, and pasturage was therefore also below average. The steers were sprayed several times during the season with DDT, which of course also influenced gains. As in 1946, this field was stocked more heavily than previously in an effort to determine what gains may be obtained from the weedy flora of this field.

Fertilizing dark air-cured tobacco

In a fertilizer test with dark air-cured tobacco, on soil of medium fertility, best yields and grades were obtained from medium to heavy applications of a mixed fertilizer. Extremely dry weather in late summer adversely affected the 1947 yields. Treatments producing the five highest yields, averages of 1946 and 1947 crops, were the following:

Treatment, lb per Acre			*Yield, lb per Acre*
N	*P*	*K*	
100	120	120	1583
30	60	120	1446
30	60	60	1412
60	60	60	1367
0	60	0*	1361

* With 10 tons manure

Varieties of dark tobacco

Dark tobacco variety studies were continued. Thirteen standard varieties and seven mosaic-resistant hybrid strains were grown. Three-year average yields (1945, 1946, and 1947) of the mosaic-resistant strains and certain standard varieties from which these resistant strains have been developed, were as follows:

	Pounds per Acre
Brown Leaf	1,278
Mosaic-resistant strains of Brown Leaf	
Ky 150	1,330
Ky 151	1,483
Ky 153	1,520
R27-44	1,454
Little Crittenden	1,486
Mosaic Resistant Little Crittenden	1,501
Little Orinoco	1,532
Mosaic Resistant Little Orinoco	1,591
Mosaic Resistant One Sucker	1,767

The mosaic resistant strains have outyielded their parent varieties in the 3-year averages, but not every year. In quality, these strains are quite similar to the parent varieties. The Brown Leaf strains are of the narrow-leaf type but are usually thick and of high quality, though often yielding less than the broad-leaf varieties. Ky 153 continues to be the highest producer of the Brown Leaf crosses. This year all of these crosses suffered much less than Brown Leaf from field fire.

Hybrid corn yields

Twenty corn hybrids, 12 white and 8 yellow, were grown in comparison with Boone County White and Reid Yellow Dent, open-pollinated varieties. Each kind of corn was replicated six times in plots containing 30 hills each with two plants per hill; hills were spaced 3½ feet apart in rows 3½ feet apart. Yields were considerably lower than in 1947 because of dry weather. Average yields of all replications were as follows:

White Corn	*Yield per Acre, bu*	*Yellow Corn*	*Yield per Acre, bu*
Ky 416	62.9	Ky 103	58.3
Ind. 750A	62.7	Dixie 44	56.2
Ky 421	61.3	Ky 175	54.6
Ind. 901A	60.3	Ky 158	52.1
Ky 423	60.0	U S 13	51.7
Ky 410	59.6	Ky 102	50.5
Ky 405B	58.9	Ky 174	48.7
Ind. 703B	57.5	Ky 180	46.7
Ky 418	57.3	Reid Yellow Dent	44.9
Ky 72B	56.7		
Ky 203	56.7		
Ky 408	54.8		
Boone County White	40.9		

Winter legumes

In a test of winter annual legumes, button clover and three strains of crimson clover were grown, each replicated three times. Clippings were weighed immediately after cutting. Total green-weight yields per acre were as follows:

	Pounds
Button clover	20,180
Crimson clover, Ky. Agr. Expt. Sta. selection	18,520
Crimson clover, commercial seed	15,325
Dixie crimson clover	13,340

Meat scrap versus a mixture of meat scrap and distillers' dried solubles for pullet growth

At the Western Kentucky Substation four broods of chicks, two each of Barred Rocks and New Hampshires, 300 chicks per brood, were started on a complete ration. When the chicks were old enough to be allowed on pasture (about 6 weeks) two broods were fed grain

and meat scrap (2 per cent salt added) in hoppers, and two broods were fed grain and a mixture of equal parts of meat scrap and distillers' corn dried solubles. When the pullets were 5 months old, 100 were selected from each group, placed in the laying house, and fed a laying mash, grain, and ground limestone. The average results were as follows:

Protein Supplement in Growth Ration	*Egg Production*	
	To March 1	*Total for Year*
Barred Rocks		
Meat Scrap	109	217
Meat Scrap and Dried Solubles	109	206
New Hampshires		
Meat Scrap	104	196
Meat Scrap and Dried Solubles	105	200

Either the meat scrap or the mixture of meat scrap and distillers' corn dried solubles was satisfactory for growing pullets having plenty of green pasture at all times.

Stop-drop sprays for Stayman and Winesap apples

In spray tests a very small amount of 2,4-D (7 to 10 ppm) was effective in retarding preharvest dropping of Stayman and Winesap apples. The spray was applied to test trees October 3, at which time harvest was under way on some trees. The test trees were picked October 29. On Winesaps, 76 percent of fruit had fallen from the check tree and only 32 percent from the sprayed trees; on Stayman, 26 percent had fallen from the check tree while only 13 percent was off the sprayed trees. Fruit color on the 2,4-D-sprayed Stayman trees was also better because on the nonsprayed trees the largest and best developed fruit seemed to fall first. This spray is very economical compared to the conventional nepthaleneactic acid, preharvest spray. However, to date, this weak 2,4-D spray has proven to be effective only on the Winesap and Stayman varieties.

Apple varieties

Lodi again led the very early varieties in yield, with a medium-sized crop. The others, Red Bird, Starr, and Yellow Transparent, had light crops. In the second-early group, Anoka bore another heavy crop. This variety is ahead, to date, in yield among the 1939 setting and though of only ordinary quality is a fair apple, when picked before full ripe. Holland and Polly Eades again produced medium good crops and William's Early Red bore its first light crop on the 9-year-old trees indicating late bearing. Wealthy produced a medium crop after a complete rest in 1946, following a heavy crop in 1945. Faurot, Conard, Paducah, Gallia Beauty, Jonared, Blaxtayman, and Turley produced medium crops, and Grove, Wright, Fyan, Golden Delicious, Starking, Colora Red York, and Missouri 1140 produced only occasional fruits.

Dwarf apple trees have beeen slow in growth at the Substation.

A few apples were produced on some of the dwarf trees in 1946 and 1947.

Fire blight was worse in 1947 than in 20 to 30 years. Of the older trees, Yellow Transparent and Jonathan were seriously affected and Grimes to a less extent. Winesap, Stayman, and Delicious were hardly affected at all. Of the younger, 9-year old trees, Starr, Conard, Jonared, and Colora Red York suffered very severe blight injury, and moderate injury was suffered by Yellow Transparent, Lodi, Faurot, Wealthy, Holland, Polly Eades, and Golden Delicious. Very little blight was seen on Paducah, Red Rome (Gallia), Wright, and Missouri 1140, and no blighted twigs were seen on Red Bird, Grove, Fyan, Turley, and Blaxtayman.

Peach varieties

All peach varieties included in the tests except Fireglow produced a good to full crop this year. Fireglow buds have winter-killed repeatedly and the variety can be considered worthless for western Kentucky. Very new sorts and selections that indicated possible future usefulness were F.V.9-93, South Haven No. 20, K53, K63, and K71. Varieties discarded in spring of 1947, because other better ones of the same season are available, were Missouri 50, June Elberta, Early Rose, Oriole, Alton, Gold Aflame, Early Hiley, Colora, Slappy, Hardee, and Redelberta. Cardinal Heath and Sure Crop Nectarine also were discarded because of brown rot trouble.

Plum varieties

Munson, America, and French Damson set heavy crops, but the yield of Bruce was somewhat reduced by frost. These four varieties have proven to be regular, dependable varieties. Those setting light crops were Early Italian Prune, Italian Prune, Gold, Shropshire Damson, and Blue Damson. This was in line with their performance on other years. Compass was discarded because of its repeated injury from the blossom blight phase of brown rot.

Grape varieties

Practically all varieties bore a full crop. Insect and disease control was, in general, excellent. Varieties proving most desirable were Concord, Fredonia, Herbert, Westfield, Muench, Wayne, and Daisy among the blacks; Delaware, Dunkirk, Ellen Scott, Catawba, Keuka, Agawam, and Vergennes of the reds; and Niagara, Portland, Ontario, Winchell, and Seneca of the whites. Those producing the largest clusters were Golden Muscat, Ellen Scott, Catawba, Concord, and Niagara.

Varieties that proved unsatisfactory because of shy bearing or small clusters were Extra, Lindley, Caco, Sheridan, Brocton, Urbana,

Norton (small clusters and berries), Moore's Early, and Campbell's Early.

Blackberry varieties

Heavy crops were borne by all varieties included in the test: Early Harvest, Eldorado, Ozark Beauty, USDA 459, and Alfred. Orange rust, however, has all but eliminated the Alfred variety. The main objection to Early Harvest is its small size. Ozark Beauty canes have often been injured by cold in the location of this planting, but would likely give good results on high, frost-free locations in western Kentucky. USDA 459 gives promise of being a useful sort of the Eldorado type.

Strawberry varieties

The four main commercial varieties produced as follows on first-year plots: Tennessee Shipper, 383 crates per acre; Tennessee Beauty, 367; Blakemore, 353; and Aroma, 207. On nearby second-year plots yields were: Tennessee Beauty, 193 crates per acre; Tennessee Shipper, 146; Blakemore, 134; and Aroma, 123. As to berry size on both first- and second-year plots, Aroma was largest, followed by Tennessee Beauty, Blakemore, and Tennessee Shipper.

Home-use berries that continued to produce well were Tennessee Supreme, Tennessee 393, Fairmore, Maytime, and Tennessee 230. New USDA selections that looked promising for home use were 2700, 3414, 2644, 2389, 4404, 3239, 2383, and 2654.

For the 5-year period of 1943-47, the following variety yields were obtained, averaging together the first- and second-year crops: Tennessee Beauty, 201; Blakemore 182; Tennessee Supreme, 181; Tennessee Shipper 176; and Aroma 103. In averaging the first-year crops, Blakemore led with 215, followed closely by Tennessee Beauty with 213; Tennessee Shipper with 212; and Tennessee Supreme, 184; while Aroma trailed with 113 crates.

ROBINSON SUBSTATION

General farming

The crop year was favorable, both the corn and the hay crops making good growth and yields. Of 16 acres in hybrid corn (Ky 103), however, practically half was destroyed by high water in August. The remainder, on high ground, yielded 60 to 70 bushels per acre.

New seedings of grass and clover brought the total pastureland to 20 acres, and hayland to 8 acres of alfalfa and Korean lespedeza.

Livestock and poultry

The project on breeding up scrub and grade dairy cattle by using purebred Brown Swiss bulls was in the fifth year. During this period

there has been a gradual improvement in the young stock from year to year. The herd now includes one Brown Swiss cow, one Swiss-Jersey cow, five Swiss-scrub cows, one scrub foundation cow, two Jersey cows, eight heifers, and five heifer calves — a total of 25 head of dairy cattle on the farm. During the year 14 head were sold.

Thirteen hundred baby chicks and 230 poults were brooded this year. At the end of the year there were 100 pullets in the laying house, and 150 turkeys. The chickens were two breeds Barred Plymouth Rock and New Hampshire. All cockerels and undesirable pullets were sold as friers. The turkeys were of June hatch and were prepared for the Christmas market.

Influence of breeding and environment in the improvement of dairy cattle

Thirty head of cattle made up of scrub cows for foundation cows, and their descendents sired by purebred Brown Swiss bulls are developing into a dairy herd at the Robinson Substation. The improvement in dairy type is recorded with photographs. Daily milk weights and monthly butterfat tests measure milk and butterfat production in terms of a lifetime series of lactations, calculated to a mature equivalent. Six very ordinary scrub cows were chosen for a foundation herd. To date fifteen lactations of these six cows have averaged 4,733 pounds of milk and 191.3 pounds of butterfat. Thus these cows selected from mountain herds when properly fed and managed, averaged 37 pounds more butterfat than the average Kentucky cow. Only two of the scrub cows have half-blood Swiss daughters which have completed comparable records of production, of 282 and 357 pounds of butterfat respectively.

Nuts

Additional pecan and walnut nursery trees were planted to increase the thriving nut planting already in production on the river bottomland soil, and a new cooperative walnut variety planting was put in on high ground in cooperation with the TVA. Six trees each of the following varieties were planted: Thomas, Michigan, Kingery, Karney, Wayside, and Hare.

Fruits

Small plots of grapes, raspberries, and strawberries are grown for demonstration purposes. The grapes were a complete failure this year, as they were frozen out twice while in bloom. Peaches, raspberries, and strawberries produced fruit of good quality which sold readily on the local market. Because of a late freeze, apples produced only half a crop, but the quality was good.

Sorghum varieties

Williams variety of sorghum again proved its superiority, producing 167 ten-pound pails of sirup of excellent quality per acre. Certified Leoti, of Texas, produced 82 pails of good quality. On the other hand, an unproved variety used extensively by Kentucky farmers in 1946 and included in these trials in 1947, produced at the rate of only 32 ten-pound pails of poor-quality sirup per acre.

NEW PROJECTS — 1947

Breeding improved varieties of wheat, oats, and barley for Kentucky.

The physiology and biochemistry of tobacco with special reference to improvement in methods of analyzing living tissues.

Fertilizer and rotation experiments with burley tobacco at the Western Kentucky Experiment Station.

Seed production in red clover and alfalfa.

Pasture research in the hill and outer bluegrass regions of Kentucky.

Studies in planning and remodeling to improve low cost farm houses.

Application of new nutritional techniques to the determination of the nutritive values of pasture forages.

Supplemented cottonseed hulls as a roughage for sheep and for beef cattle.

Parasites of horses.

Equine virus abortion.

Simultaneous infection of chickens by two or more species of Animal Parasites.

Pneumoencephalitis (Newcastle disease).

A study of the farm family in Kentucky.

A study of the economics of the small farm.

Some factors affecting firmness of tissue structure, color and palatability of frozen berries and vegetables and their effect on the ascorbic acid content of the products.

The intermediary metabolism of riboflavin, thiamine and choline in human beings.

Factors affecting the dispersion in prices of tobacco of the same grade at auction markets.

Suitable containers for marketing green-wrapped tomatoes for shipment by truck and railroad.

Efficiency of labor and equipment in handling tobacco on loose-leaf warehouse floors.

Factors determining consumers' choice of fruits and vegetables in the Louisville market.

Marketing spring lambs and veal calves by carcass weight and grade.

The development and analysis of improved techniques for marketing eggs.

Maintaining and expanding the market for dairy products.

PUBLICATIONS

BULLETINS

497. Seasonal patterns of tobacco sales and prices from river-warehouse days to the present looseleaf auctions. Carl M. Clark. January, 1947.
498. Reproductive phenomena in ageing hens. W. M. Insko, Jr., Dewey G. Steele, and E. T. Wightman. March, 1947.
499. Arizona group of paracolon bacteria. A new group of bacteria pathogenic for animals and probably also for man. P. R. Edwards, Mary G. West, and D. W. Bruner. April, 1947.
500. People and resources in Eastern Kentucky. A study of a representative area in Breathitt, Knott, and Perry Counties. Howard W. Beers and Catherine P. Heflin.
501. Principles of Burley tobacco barn operation. Lester S. O'Bannon. May, 1947.
502. European corn borer in Kentucky. P. O. Ritcher. May, 1947.
503. Effect of different methods of cooking on the thiamine, riboflavin, and niacin content of pork. S. E. Erikson and R. E. Boyden. June, 1947.
504. Thiamine and riboflavin content of turkey cooked by institution methods. S. E. Erikson and R. E. Boyden. June, 1947.
505. Mobility of rural population. A study of changes in residence and occupation in two types of rural communities. Howard W. Beers. June, 1947.
506. Larvae of Geotrupinae. With keys to tribes and genera (Coleoptera: Scarabaeidae). P. O. Ritcher. August, 1947.
507. Farms and forests of Eastern Kentucky in relation to population and income. An appraisal of population and land resources and their potentials. William A. Duerr, John H. Bondurant, W. D. Nicholls, Howard W. Beers, R. O. Gustafson, and John B. Roberts. August, 1947.
508. *Miris dolobratus* (Linn.) and *Amblytylus nasutus* (Kirschbaum). Two destructive insect pests of Kentucky bluegrass. H. H. Jewett and Lee H. Townsend. September, 1947.
509. Infections of fetuses and foals. W. W. Dimock, P. R. Edwards, and D. W. Bruner. September, 1947.
510. The Louisville fall-premium plan for seasonal milk pricing. John B. Roberts. November, 1947.
511. Effect of calcium chloride on firmness of some canned products and on their content of ascorbic acid. S. E. Erikson and R. E. Boyden. December, 1947.

REGULATORY SERIES BULLETINS

55. Commercial fertilizers in Kentucky, 1946. Including a report on official fertilizer samples analysed. July-December, 1946. Bruce Poundstone. April, 1947.
56. Some items of interest to Kentucky Nurserymen. For the year ended June 30, 1947. W. A. Price and Howard G. Tilson. July, 1947.
57. Commercial feeds in Kentucky, 1946. Including a report on official feed samples analyzed. October-December, 1946. Bruce Poundstone. July, 1947.
58. Quarterly report on official feed samples analyzed. January, February, and March, 1947. July, 1947. Bruce Poundstone.
59. Seed inspection in Kentucky, 1946-47, by the Entomology and Botany Department, Kentucky Agricultural Experiment Station. Annual Report for the year July 1, 1946 to June 30, 1947. W. A. Price. August, 1947.
60. Inspection of commercial fertilizers. Semiannual Report, January-June, 1947. Bruce Poundstone. October, 1947.

ANNUAL REPORT

Fifty-ninth Annual Report of the Experiment Station (for 1946). Thomas P. Cooper, Director. May, 1947.

EXPERIMENT STATION CIRCULAR

61. Early clinical examination of mares for pregnancy. W. W. Dimock.

PROGRESS REPORT (mimeopraphed)

Some facts on Kentucky churches in town and country. Harold F. Kaufman. August, 1947.

MISCELLANEOUS

Kentucky Fruit Notes, issued quarterly (January, May, August, and November). W. D. Armstrong, Editor.

SCIENTIFIC PAPERS

In Agronomy

Can tobacco plant beds in Kentucky and Tennessee be infected by *Peronospora tabacina* blown in from Texas. W. D. Valleau. The Plant Disease Reporter, U.S.D.A. 31 (12): 480-482. 1947.

Changes in the chlorophyll and carotene contents of curing Burley tobacco cut at various stages of maturity. R. N. Jeffrey and R. B. Griffith. Plant Physiol. 22: 34-41. January, 1947.

Clubroot of tobacco: a wound-tumorlike graft-transmitted disease. W. D. Valleau. Phytopathology 37: 580-582. 1947.

Crazy top of corn in Kentucky. L. M. Josephson and E. M. Johnson. Plant Disease Reporter 31: 69-70. February, 1947.

The effect of phosphorus fertilization on chemical composition and forms of phosphorus in mature corn crops. M. E. Weeks and Alice Walters. Soil Soc. Amer. Proc. 11: 189-194.

Injury to plants by minute amounts of 2, 4 dichlorophenoxyacetic acid. E. M. Johnson. Phytopathology 37: 367-369, May, 1947.

Meadow nematodes and brown root rot of tobacco. W. D. Valleau and E. M. Johnson. Abstract. Phytopathology 37: 22. January, 1947.

Reaction of 35 species of Nicotiana to tobacco streak virus. Stephen Diachun and W. D. Valleau. Abstract. Phytopathology 37: 7. January, 1947.

The relation of meadow nematodes to brown root rot of tobacco. W. D. Valleau and E. M. Johnson. Phytopathology 37 (11): 838-841. 1947.

Some factors influencing inoculation of tobacco with streak virus, Stephen Diachun. Abstract. Phytopathology 37: 6. January, 1947.

In Animal Industry

Digestibility of some pasture forages by steers and wethers as affected by the chemical composition of the forage. R. M. Forbes and W. P. Garrigus. Amer. Soc. Anim. Prod. Proc., published in the Journal of Animal Science, November, 1947.

The effects of bluegrass as pasture or silage used continuously during the year in connection with an all-mash ration for laying hens. G. Davis Buckner, W. M. Insko, Jr., Amanda H. Henry, and Elizabeth F. Wachs. Presented at annual meeting of Ky. Acad. Sci., April 25-26, 1947.

Embryonic mortality in relation to age of hen. W. M. Insko, Jr., Dewey G. Steele, and E. T. Wightman. Presented at annual meeting of Ky. Acad. Sci., April 25-26, 1947.

Rates of growth and calcification of the sternum of male and female New Hampshire chickens. G. Davis Buckner, W. M. Insko, Jr., Amanda Harms Henry, Elizabeth F. Wachs, and D. W. MacLaury. Presented at annual meeting of Poultry Science Association, August 28, 1947.

IN ANIMAL PATHOLOGY

Assembly line technic for cleaning used slides and cover glasses. Zae N. Wyant. Amer. Jour. Clin. Path. 17 (11): 917-918, November, 1947.

Changes inducted in the nonspecific antigens of Salmonella. D. W. Bruner and P. R. Edwards. Jour. Bact. 53: 359. March, 1947.

A group of diphasic paracolon bacteria. Mary G. West, P. R. Edwards and D. W. Bruner. Jour. Infect. Dis. 81: 24-27, July-August, 1947.

Infections observed in equine fetuses and foals. W. W. Dimock, P. R. Edwards, and D. W. Bruner. Cornell Vet. 37 (2): 89-99. April, 1947.

Intertransformability of *Salmonella simsbury* and *Salmonella senftenberg*. P. R. Edwards, Mary G. West, and D. W. Bruner. Soc. Expt. Biol. and Med. Proc. 66: 230-232, October, 1947

Jaundiced foals. D. W. Bruner, F. E. Hull, P. R. Edwards, and E. R. Doll. The Blood Horse 50: 654, December, 1947.

Low blood magnesium and associated tetany occurring in cattle in the winter. Robert H. Udall. Cornell Vet. 37 (4):314-324, October, 1947.

Mercury poisoning in swine. E. L. Taylor, Amer. Vet. Med. Assoc. Jour. 61 (844): 46-47, July, 1947.

A new Salmonella type isolated from man. Salmonella Texas. James Watt, Thelma M. DeCapito and Alice B. Moran. U. S. Public Health Reports 62: 808-809. May 30, 1947.

Newcastle disease in a group of young chicks. D. W. Bruner, P. R. Edwards, and E. R. Doll. Amer. Vet. Med. Assoc. Jour. 110: 382-3. June, 1947.

Paratyphoid infection (Wing's disease). Ross Brown and M. C. Duff. Racing Pigeon Bulletin 2 (88): 1-3, November, 1947.

Ruptured prepubian tendon in a ewe. E. R. Doll. The Aub. Vet. 3 (3): 126, summer, 1947.

Salmonella types encountered by the 15th Medical General Laboratory. D. W. Bruner and B. J. Joyce. Amer. Jour. Hyg. 45: 19-24, January, 1947.

Selection of Salmonella and Shigella cultures for serologic classification. W. H. Ewing and D. W. Bruner. Amer. Jour. Clin. Path. 17: 1-12, January, 1947.

The serologic classification of the Arizona group of paracolon bacteria. P. R. Edwards, Mary G. West, and D. W. Bruner, Jour. Infect. Dis. 81: 19-23, July-August, 1947.

Serum levels of penicillin in horses and sheep following injections in a water-in-oil vehicle. E. R. Doll and F. E. Hull. Vet. Med. 42: 25-26, January, 1947.

Two related Salmonella types: *S. luciana and S. Marseille.* Alice B. Moran, P. R. Edwards, D. W. Bruner. Soc. Expt. Biol. and Med. Proc. 64: 89, January, 1947.

The use of a polyvalent antiserum for preliminary identification of Salmonella cultures. W. H. Ewing and D. W. Bruner. Jour. Bact. 53: 362-363, March, 1947.

In Chemistry

Carbohydrate metabolism of Johnson grass. Karl E. Rapp. Amer. Soc. Agron. Jour. 39. October, 1947.

Determination of cellulose in agricultural residues. Modification of the Norman-Jenkins method. E. B. Lewis and J. S. McHargue. Indus. and Engin. Chem. Jour. (Analyt. Ed.) 19 November, 1947

Report on boron in soils. C. A. Evans and J. S. McHargue. Indus. and Engin. Chem. Jour. (Analyt. Ed.) 30, May 15, 1947.

In Entomology and Botany

Description of the larva of Pleocoma hirticollis vandykei Linsley (Coleoptera, Scarabaeidae). P. O. Ritcher. Pan-Pacific Ent. 23 (1): 11-20. January, 1947.

In Feed and Fertilizer

Determination of phosphoric acid in fertilizers in the presence of organic matter. H. R. Allen and Lelah Gault. Assoc. Off. Agr. Chem. Jour. 30: 135-139. February, 1947.

Report on sampling fertilizers. H. R. Allen. Paper presented at annual meeting of the Assoc. Off. Agr. Chem., 1947.

In Horticulture

Dwarf apple trees at the Kentucky Experiment Station. C. S. Waltman. Fruit Varieties and Horticultural Digest, 2 (3): 83-85, Autumn, 1947.

The effect of late fertilizer applications on potato tissue extract concentrations and yields of tubers. E. M. Emmert. Southern Agricultural Workers' Association Proc., 1947.

FINANCIAL STATEMENT

Receipts and expenditures under Hatch, Adams, Purnell, and Bankhead-Jones Acts, and the State Offset Required by the Bankhead-Jones Act
Fiscal year ended June 30, 1947

	Hatch	*Adams*	*Purnell*	*Bankhead-Jones*	*Bankhead-Jones Offset*
Receipts					
From the Treasurer of the United States as per appropriations for fiscal year ending June 30, 1947	$15,000.00	$15,000.00	$60,000.00	$88,327.80	
Receipts from sources within the state as Bankhead-Jones offset					$88,327.80
Expenditures					
Personal Services:					
Administration	3,208.33				
For all other purposes	10,996.60	14,998.20	53,179.17	80,920.52	
Travel	164.83		2,639.09	1,396.76	
Transportation of Things			5.74	27.21	
Communication Service			27.84	5.75	
Printing and Binding:					
Printing publications	630.24		3,373.06	2,712.63	
Other Contractual Services:					
Repairs and alterations to equipment, and other contractual services not otherwise classified			218.92	68.23	
Other supplies and materials		1.80	452.68	2,882.45	
Equipment			103.50	314.25	
TOTAL EXPENDITURES	15,000.00	15,000.00	60,000.00	88,327.80	
Unexpended Balances, June 30, 1947	None	None	None	None	
BANKHEAD-JONES OFFSET, TOTAL APPROVED EXPENDITURES					$88,327.80

We, the undersigned certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones, Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement: that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

(Signed) THOMAS COOPER
Director of Experiment Station

(Signed) FRANK D. PETERSON
Comptroller (Legal Custodian of Federal funds)

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